DOCUMENT RESUME

ED 209 471 CE 030 464

AUTHOR Vos, Robert; Sandiford, Janice R.
TITLE Metric Education Resources for Health Educators. A Workshop for Health Educators.
INSTITUTION Florida International Univ., Miami.
PUB DATE Nov 81
NOTE 94p.

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Allied Health Occupations Education; Behavioral Objectives; Elementary Secondary Education; *Inservice Teacher Education; Integrated Curriculum; Learning Activities; *Metric System; Postsecondary Education; Pretests Posttests; *Resource Materials; Teacher Workshops; Transparencies; Vocational Education

ABSTRACT

These workshop materials are designed to provide basic information and develop competencies necessary for the health occupations teacher to use and integrate metrics into the curriculum. Objectives and activities of the three-hour workshop are outlined. Informational materials cover historical development of the metric system, metric units, metric equivalents, rationale for metrification, and metric symbols. A glossary of metric terms is provided. Questions to guide discussion about the metric system are listed. Material specific to use of the metric system in the field of health is then provided. Activities are included that allow for practice in using the metric system and identifying strategies for implementing metric education into the health occupations curriculum. A pretest and prepost test are presented. Ten transparency masters that may be used by the teacher in the classroom are also given. A 12-page bibliography compiled by the National Council of Teachers of Mathematics lists metric information sources in these categories: books, workbooks, and posters; manipulative aids and kits; films and filmstrips; filmloops and videocassettes; slides and transparencies; audiocassettes and records; periodicals, reports and pamphlets; games; and duplicating masters. (YLB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED209471

METRIC EDUCATION RESOURCES

for

HEALTH EDUCATORS

A Workshop for Health Educators

by

Robert Vos, Ed.D.
Janice R. Sandiford, Ph.D.

November, 1981

CE030464

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

R. Voss
J. Sandiford

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

METRIC EDUCATION RESOURCES

Table of Contents

General Description	1
Objectives	1
Training Activities	2
Historical Development of the Metric System	3
Historical Perspective Toward Metrication	6
All You Need to Know About Metric	7
A Short Course in Metrics	8
Metric Equivalent Table	9
Base Units of the SI Metric System	10
Multiples and Submultiples - SI Metric System	11
Metrics: How, When, Why?	12
To Convert or Not to Convert	14
Glossary of Metric Terms	16
Discussion Questions	22
Centimetre Grid	24
Metre Stick	25
Health Occupations	26
Metric Activities	34
Are You Ready for Metrics?	54
Pre-Post Test	56
Overhead Transparencies	58
Bibliography of Metric Information	69

METRIC EDUCATION

A WORKSHOP FOR HEALTH EDUCATORS

General Description

This workshop is designed to provide the basic information and develop the competencies necessary for the health occupations teacher to use and integrate metrics into the curriculum. The workshop will begin with a review of the major metric units and discussion of how metrics will effect health occupations. Participants will be introduced to the metric system as it relates to health occupations and develop competencies in group and individual activities. Participants will be engaged in activities and exposed to strategies that may be integrated into their own curriculum. The occupation specific modules used in this workshop contain metric measurement information related to health occupations, as well as overhead transparency masters that may be used by the teacher in his/her classroom.

Objectives

At the conclusion of a three hour workshop covering the introduction to the metric system the participant will be able to:

1. Measure length, area, mass, capacity, volume and temperature in metric units.
2. Identify strategies for integrating metric instruction into the curriculum.
3. Identify the effects metric measurement will have on health occupations.

Training Activities

During this three hour workshop the participants will:

Minutes	
20	1. take a pre-test and score the test,
20	2. view the film strip "Think Metric" introducing the metric system of measurement,
40	3. participate in a lecture/discussion,
60	4. divide into groups and review the material and perform selected activities identified in this workshop guide,
20	5. identify strategies for implementing metric education into the health occupations curriculum,
20	6. take a post-test and score the test.
180	

HISTORICAL DEVELOPMENT OF THE METRIC SYSTEM

It is widely supported that the concept of the metric system originated with the French mathematician, Gabrill Mouton, who proposed a comprehensive decimal measurement system based on a unit of length equal to a portion of an arc representing the distance between the North Pole and the equator. Numerous other proposals were made, yet over a century later, no uniform measurement standards had gained wide acceptance. It was not until 1790, that the French Academy of Sciences developed the metric system based upon the work of Mouton and others.

It may be well to note here that although there were no national or international standards for measurement, there were numerous measurement systems in use. Measurement systems evolved wherever they were needed but very little uniformity existed. Our customary system, as used today, is not based on a single concept but rather on numerous imprecise concepts. For example, the inch was once described as the length of three barley grains laid end to end; a furlong, the distance a man and mule could plow in one day; and a pound as the weight of 7,200 dried barley corn grains. Considering these examples, it becomes evident why some uniform standards of measurement were necessary.

The metric system, as finally adopted by the French National Assembly in 1795, was both simple and scientific. The unit of length, (metre) was defined as a portion of the earth's circumference and measures for volume (litre) and weight (gram) were derived from this unit of length therefore relating the basic units of the system to each other and to nature. Larger and smaller variations of these units were created by multiplying or dividing by 10 and its powers. The metric system is therefore referred

to as a "base-10" or "decimal" system.

The metric system gained popular use on the European continent due to the efforts of Napolean Bonaparte. During his sweep across Western Europe, conquered countries were forced to utilize the system. Because of the ease of the system, these countries retained it after Napolean left power.

In the United States the need for a unified system of weights and measures was also recognized. It was Thomas Jefferson who, in 1790, as Secretary of State, was requested to prepare a plan. Although Jefferson's plan was not adopted, three main principles of the plan are actually evident in the metric system. They are:

1) The standard unit of length should be based on some unchanging, absolute standard found in the physical universe.
2) Length, volume and weight should be directly related to each other.
3) The subdivisions and multiples of each unit should be based on the decimal system.

The adoption of the metric system was encouraged by worldwide scientific societies to achieve some uniformity in world commerce. In 1795, copies of the metric standard units were sent to the United States by France but Congress took no action to approve the system. President Madison, in 1816, reminded Congress that the United States still had no uniform system of weights and measures. A study was prepared and in 1821, "The Report Upon Weights and Measures", listed advantages and disadvantages of the English (customary) and metric systems. Although the report encouraged a great deal of discussion, no action was taken.

Between 1830 and 1856, the yard, the avoirdupois pound and the Winchester bushel were to become official units of measure in the United States. Interest in the metric system did not subside, however. The United States joined other countries in signing the "Treaty of the Metre" which established the International Bureau of Weights and Measures. By 1893 the United States had actually redefined the yard and pound in terms of the metre and kilogram, but had not adopted the metric system for use.

Throughout the early and mid 1900's, attempts were made to adopt the metric system. In 1968, Congress directed the Secretary of Commerce to start the U.S. metric study. The report, delivered in 1971, recommended that the United States change to the International System of Units deliberately and carefully. Again, Congress took no action.

Congress, in 1974, recognizing the growing number of businesses and industries committed to metric changeover, included a section in PL 93-380 that obligated the U.S. Office of Education to make provisions for metric education. In December of 1975, the Metric Conversion Act became Public Law 94-164. This Act authorized the President to appoint a Metric Conversion Board with responsibility for regulating the voluntary metric conversion in the United States.

The Florida Metric Council was foumulated in 1976 by Cabinet Resolution to plan for Florida's overall conversion to metrics. The major obstacle facing Florida's conversion, however, is the apparent inactivity at the federal level pursuant to the Metric Conversion Act of 1975. Metric training literature and programs have been developed by the public and private sector and are in use today. Florida educators have made a firm commitment to bring Florida into the metric age!

HISTORICAL PERSPECTIVE TOWARD METRICATION

1670 Gabriel Mouton proposed a decimal system of weights and measures.

1790 Development of the metric system by the French Academy of Sciences. U.S. Congress notes the need for a uniform system of weights and measures, but takes no action.

1795 France officially adopts the metric system.

1821 John Quincy Adams metric study receives extensive attention, but no action by Congress.

1840 Metric system made compulsory in France.

1850 Spain, Netherlands, Greece and Italy adopt the metric system.

1866 Legislation makes it legal in the U.S. to use the metric system in trade. Use is voluntary.

1875 U.S. signs "Treaty of the Metre". The International Bureau of Weights and Measures is established.

1890 U.S. receives prototype metres and kilograms. Most of Europe and South America has gone metric.

1893 The metric prototypes become the fundamental standards by which the customary measures are defined.

1960 The metre is redefined as equal to 1,650,763.73 wavelengths of the orange-red line of krypton 86 under specific conditions.

1965 Great Britain starts metrication.

1968 Congress initiates a three-year metric study.

1971 U.S. Metric Study recommends U.S. begin a 10-year conversion plan.

1974 PL 93-380, authorizes a Metric Education Program.

1975 Congress passes and President signs Metric Conversion Act of 1975.

Today Only Brunei, Burma, Liberia and Yemen not committed to metrication.

UNITED STATES METRIC BOARD

Suite 600
1815 North Lynn Street
Arlington, Virginia 22209

All You Will Need to Know About Metric

(For Your Everyday Life)

10

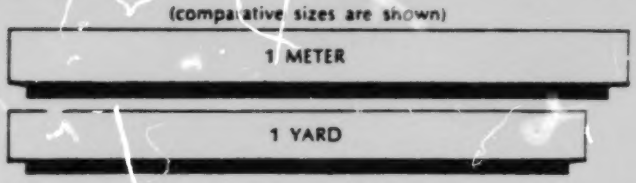
Metric is based on Decimal system

The metric system is simple to learn. For use in your everyday life you will need to know only ten units. You will also need to get used to a few new temperatures. Of course, there are other units which most persons will not need to learn. There are even some metric units with which you are already familiar: those for time and electricity are the same as you use now.

BASIC UNITS

METER: a little longer than a yard (about 1.1 yards)
LITER: a little larger than a quart (about 1.06 quarts)
GRAM: a little more than the weight of a paper clip

(comparative sizes are shown)



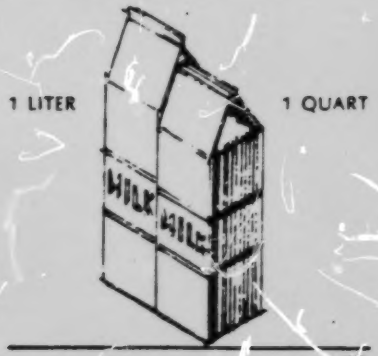
25 DEGREES FAHRENHEIT

25 DEGREES CELSIUS

COMMON PREFIXES
(to be used with basic units)

milli: one-thousandth (0.001)
centi: one-hundredth (0.01)
kilo: one-thousand times (1000)

For example:
1000 millimeters = 1 meter
100 centimeters = 1 meter
1000 meters = 1 kilometer



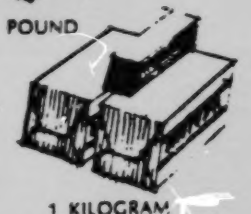
OTHER COMMONLY USED UNITS

millimeter:	0.001 meter	diameter of paper clip wire
centimeter:	0.01 meter	a little more than the width of a paper clip (about 0.4 inch)
kilometer:	1000 meters	somewhat further than ½ mile (about 0.6 mile)
kilogram:	1000 grams	a little more than 2 pounds (about 2.2 pounds)
milliliter:	0.001 liter	five of them make a teaspoon

1 POUND

OTHER USEFUL UNITS

hectare: about 2½ acres
metric ton: about one ton

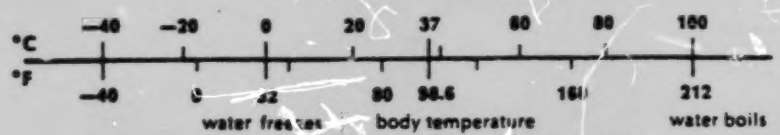


1 KILOGRAM

WEATHER UNITS:

FOR TEMPERATURE
degrees Celsius

FOR PRESSURE
kilopascals are used
100 kilopascals = 29.5 inches of Hg (14.5 psi)



A SHORT COURSE IN METRICS

Metric is based on a Decimal system

All you will really need to learn is ten new units. The units you now use for time and electricity will remain the same.

Basic Units

Meter, liter, gram and Celsius degree (which replaces centigrade) are the basic units.

METER
a little longer than a yard (about 1.1 yards)

LITER
a little larger than a quart (about 1.06 quarts)

GRAM
a little more than the weight of a paper clip

Common Prefixes

(to be used with basic units)

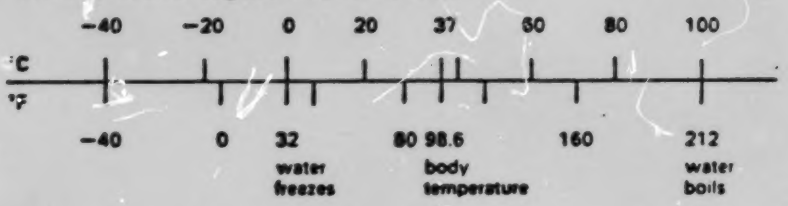
milli: one-thousandth (0.001)
centi: one-hundredth (0.01)
kilo: one-thousand times (1000)

For example:

1000 millimeters = 1 meter
100 centimeters = 1 meter
1000 meters = 1 kilometer

CELSIUS

TEMPERATURE degrees Celsius are used



Other Commonly Used Units

millimeter:	0.001 meter	diameter of paper clip wire
centimeter:	0.01 meter	a little more than the width of a paper clip (about 0.4 inch)
kilometer:	1000 meters	somewhat further than ½ mile (about 0.6 mile)
kilogram:	1000 grams	a little more than 2 pounds (about 2.2 pounds)
milliliter:	0.001 liter	five of them make a teaspoon

Other Useful Units

hectare: about 2½ acres
tonne: about one ton

METRIC EQUIVALENT TABLE

Prefix meanings:

kilo means 1000	deci means 0.1 or 1 part of 10
hecto means 100	centi means 0.01 or 1 part of 100
deka means 10	milli means 0.001 or 1 part of 1000

METER TABLE - Linear

1 kilometer . . . . . 1000 meters	1 meter . . . . . 0.001 kilometer
1 hectometer . . . . 100 meters	1 meter . . . . . 0.01 hectometer
1 dekameter . . . . . 10 meters	1 meter . . . . . 0.1 dekameter
1 METER . . . . . 1 meter	1 meter . . . . . 1 meter
1 decimeter . . . . . 0.1 meter	1 meter . . . . . 10 decimeters
1 centimeter . . . . 0.01 meter	1 meter . . . . . 100 centimeters
1 millimeter . . . . 0.001 meter	1 meter . . . . . 1000 millimeters

LITER TABLE - Capacity

1 kiloliter . . . . . 1000 liters	1 liter . . . . . 0.001 kiloliter
1 hectoliter . . . . 100 liters	1 liter . . . . . 0.01 hectoliter
1 dekaliter . . . . . 10 liters	1 liter . . . . . 0.1 dekaliter
1 LITER . . . . . 1 liter	1 liter . . . . . 1 liter
1 deciliter . . . . . 0.1 liter	1 liter . . . . . 10 deciliters
1 centiliter . . . . 0.01 liter	1 liter . . . . . 100 centiliters
1 milliliter . . . . 0.001 liter	1 liter . . . . . 1000 milliliters

GRAM TABLE - Weight (Mass)

1 kilogram . . . . . 1000 grams	1 gram . . . . . 0.001 kilogram
1 hectogram . . . . . 100 grams	1 gram . . . . . 0.01 hectogram
1 dekagram . . . . . 10 grams	1 gram . . . . . 0.1 dekagram
1 GRAM . . . . . 1 gram	1 gram . . . . . 1 gram
1 decigram . . . . . 0.1 gram	1 gram . . . . . 10 decigrams
1 centigram . . . . . 0.01 gram	1 gram . . . . . 100 centigrams
1 milligram . . . . . 0.001 gram	1 gram . . . . . 1000 milligrams

Note: Care must be exercised in area and volume equivalents in the explanation of the prefixes. Example:

$1\ m^3 = 1000\ dm^3$ (10^3 or 10 x 10 x 10)

BASE UNITS OF THE SI METRIC SYSTEM

Unit	Symbol	Definition
metre (length)	m	The metre is equal to a specific number of wavelengths of the light given off by the atom krypton-86. Commonly used related measures are the kilometre (km) = 1000 metres; the centimetre (cm) = 0.01 (one-hundredth) metre; and the millimetre (mm) = 0.001 (one-thousandth) metre.
kilogram (mass)	kg	The kilogram is equal to the mass of the standard kilogram cylinder located at the International Bureau of Weights and Measures in France. A copy of this kilogram is located at the National Bureau of Standards in Washington, D.C. The kilogram is often used to measure what we commonly call weight. However, a weight is actually based upon mass and the pull of gravity. Common related measures are the gram (g) = 0.001 (one-thousandth) kilogram and the milligram (mg) = 0.001 (one-thousandth) gram.
second (time)	s	The second is equal to a specific number of movements of the cesium atom in a device known as an atomic clock. A common related measure is the millisecond (ms) = 0.001 (one-thousandth) second. The minute, hour, day, and year are also used, although they are not SI units because they are not based upon ten.
kelvin (temperature)	K	The kelvin is equal to a specific fraction of the temperature at which water exists as a solid, liquid and vapor. This is called the triple point of water. The kelvin is used mainly for scientific measurements. For practical, everyday purposes, the degree Celsius (°C) is used. Water boils at 100°C, and it freezes at 0°C. The Celsius scale is equal to, but replaces, the old Centigrade temperature scale.
ampere (electric current)	A	The ampere is equal to the amount of current in two parallel wires one metre apart, that results in a specific force between the two wires. The milliampere (mA) = 0.001 (one-thousandth) ampere, is a common related measurement.
candela (luminous intensity)	cd	The candela is equal to the amount of light given off by platinum at its freezing point, under pressure. At this freezing point, platinum is glowing hot. The candela is used to measure an amount of light.
mole (amount of substance)	mol	The mole is equal to the number of particles contained in a specific amount of carbon. This unit is used mainly in special scientific measurements.

Multiples and Submultiples - SI Metric System

Most educators will not need the very large multiples or the very small submultiples used in the SI Metric System. The 16 common prefexes are included here for informational purposes.

Prefix	*Symbol*	*Multiples and Submultiples*		
exa	E	1 000 000 000 000 000 000	(10^{18})	one quintillion
peta	P	1 000 000 000 000 000	(10^{15})	one quadrillion
tera	T	1 000 000 000 000	(10^{12})	one trillion
giga	G	1 000 000 000	(10^{9})	one billion
mega	M	1 000 000	(10^{6})	one million
kilo	k	1000	(10^{3})	one thousand
hecto	h	100	(10^{2})	one hundred
deka	da	10	(10^{1})	ten
deci	d	0.1	(10^{-1})	one tenth
centi	c	0.01	(10^{-2})	one hundredth
milli	m	0.001	(10^{-3})	one thousandth
micro	μ	0.000 001	(10^{-6})	one millionth
nano	n	0.000 000 001	(10^{-9})	one billionth
pico	p	0.000 000 000 001	(10^{-12})	one trillionth
femto	f	0.000 000 000 000 001	(10^{-15})	one quadrillionth
atto	a	0.000 000 000 000 000 001	(10^{-18})	one quintillionth

METRICS: How, When, Why?

The change to metrics in the United States is primarily for economic reasons. To remain competitive in a world market, that is virtually all metric, U.S. corporations have had to affect a voluntary change over to metric measurement. The use of metric measurement in trade has been legal in the U.S. for over a century. Such fields as medicine, science, electronics, and even the postal service have been metric for almost that long. In 1960 pharmaceutical manufacturers changed most of their products to metric specifications.

Industries have been encouraged to convert to the metric system by economic need and federal mandate. The Metric Conversion Act of 1975 recommended the development of a rational plan for voluntary change over. As the various sectors of our economy are ready for change over, the change will take place. Some of American's largest retailers such as Sears, Montgomery Ward and Penneys, even though not motivated by world markets, are leading the way to a metric United States.

In consumer products, metric conversion can be completed in three stages. These are: (1) dual labeling, (2) soft conversion, and (3) hard conversion.

Dual labeling involves no change other than labeling the product in customary and metric terms. This stage is recommended simply for familiarization. The main problem with dual labeling is that most people tend to ignore the new measure and rely on the more familiar customary measure. We still buy 12 oz. sodas not 355 ml sodas.

Soft conversion again requires no changes other than the customary measure is dropped from the package and only the metric measure applies. The product remains the same size and the metric measures are rounded off to eliminate decimals. Problems with soft conversion occur when the

converted metric measure end up uneven or "odd" quantities. For example: a 10 oz. box of cookies becomes 283 g, a quart of milk would be 946 ml and a square foot would be 0.092 m^2.

The long range goal of conversion is hard conversion. This is considered the last and permanent stage. Hard conversion requires a major readjustment because it calls for elimination of impractical, unpopular and uneconomical sizes of tools and products. The 283 g box of cookies may become 250 g the 355 ml can of soda may become 350 ml or 300 ml. It is obvious that hard conversion will be the most difficult stage but it will offer industry the opportunity to develop simple uniform sizes. Evidence of hard conversion is evident today in the soft drink and liquor industry.

The conversion to metric standards in some industries may be up to 50 years away. Others are converting at their convenience, and still others are already completely converted. As the economic sector of our country recognizes the desirability of going metric we will become a metric nation.

TO CONVERT OR NOT TO CONVERT

It is the opinion of educators that in learning the metric system, conversions from the metric system to the customary system and the customary to the metric should be kept to a minimum. Some believe that conversions should not be part of metric education at all. It is best, they believe, for the student to think in only one measurement system. Obviously, some conversion is desireable, but students should not be encouraged to commit conversion factors to memory. It would be best if they learn to recognize common objects and their metric measurements, for example: A 5 cm paper clip has a width of approximately one centimetre, the wire is approximately one millimetre in diameter and it weighs approximately one gram. Speaking of a metre in terms of a measure "a little longer than a yard", is actually better than saying 39.37 inches unless it is necessary to convert a specific measurement.

USING PROPER METRIC (SI) SYMBOLS

It is important for the teacher to stress, by example, correct usage of SI symbols. The rules below should serve as a guide.

1. Metric symbols should not be followed by a period unless they are at the end of a sentence

   cm NOT c.m. or cm.

2. Abbreviations and symbols are written in singular form. An "s" is not added to form a plural or possesive.

   5 kg NOT 5 kgs

3. Metric symbols should be used instead of full names when units are used in conjunction with numerals.

   6 l NOT 6 litres

4. Square and cubic unit symbols should be expressed using the exponents.

$4\ cm^2$ NOT four square cm

5. Decimal fractions are used rather than common fractions.

6.5 cm NOT 6 1/2 cm

To eliminate the fraction 6.5 cm becomes 65 mm.

6. Compound symbols use a slash (/) for the word "per". As in kilometres per hour - km/h.

7. When writing numbers less than one, a zero is placed in front of the decimal point.

0.25 m NOT .25 m

8. Grouped numbers are separated by a space not a comma. In European countries the comma is used as a decimal point.

60 000 km NOT 60,000 km

Four digit numbers do not require a space.

1000 m NOT 1 000 m

9. A space is left between the last digit of a numeral and the symbol.

5 m NOT 5m

10. Unit names and symbols (except degrees Celsius, ^{o}C) are written in lower case letters unless they are used at the beginning of a sentence.

MASS OR WEIGHT

When speaking in metric terms it will be necessary for educators to refer to what has commonly been referred to as weight as mass. In common practice weight has been used to refer to both the concept of force and mass. In scientific applications weight refers to the concept of force. It is therefore necessary to refer to the mass of an object rather than its weight.

GLOSSARY OF METRIC TERMS

AREA - Small areas are usually measured in square centimetres (cm^2). In building construction the square meter (m^2) is used. The hectare (ha) is used for land surveys. (See the individual terms for more specific definitions).

LENGTH - The common metric units of length are the millimetre (mm) for small diminsions, the centimetre (cm) for daily practical use, the metre (m) for expressing dimensions of larger objects and short distances and kilometre (km) for longer distances. (See the individual terms for more specific definitions).

MASS - For most uses the kilogram (kg) is the convenient measure. In pharmaceutical and scientific work the gram (g) is the unit used. Farm commodities, minerals and other large shipments are measured by metric ton (t). (See the individual terms for more specific definitions).

TEMPERATURE - Temperature is measured on the Celsius (^oC) scale. The preferred temperature scale for engineering and physics is kelvin (k). (See the individual terms for more specific definitions).

VOLUME - The most convenient unit is the cubic decimetre (dm^3) which is more commonly referred to as the litre (l). In dispensing drugs the preferred unit is the cubic centimetre (cm^3) or millilitre (ml) as it is also called. In excavation work and in pouring concrete the cubic metre (m^3) is used. (See the individual terms for more specific definitions).

ARE - (a) - A unit of area equal to 100 $m.^2$.

CELSIUS - The scale, formerly called centigrade, which is used to measure temperature. On the Celsius scale water freezes at 0^oC and boils at 100^oC. Normal human body temperature is 37^oC, while a comfortable swimming temperature is about 28^oC. (See also kelvin).

CENTIMETRE - (cm) - One hundredth (0.01) of a metre (or 10 mm). A penny is approximately 2 cm in diameter.

DECIMETRE - (dm) - One tenth (0.1) of a metre (or 10 cm).

DEKAMETRE - (dkm) - Ten metres (10 m). Not commonly used.

GRAM - The gram (g) is a unit of mass. A paper clip weighs approximately one gram. There are slightly less than 30 g in one ounce.

HECTARE - (ha) - The unit of area used to measure land. Equal to 100 a which is approximately 2.5 acres.

HECTOMETRE - (hm) - One hundred metres (100m). Not commonly used.

KELVIN - (k) - The temperature scale used for engineering and physics. The freezing point of water on the kelvin scale is 273.15 K.

KILOGRAM - The kilogram (kg) is the unit of mass most commonly used. Its mass is slightly greater than two pounds.

KILOMETRE - The kilometre (km) is the unit of length commonly used to express distances. Equal to one thousand metres (1000 m).

LITRE - The litre (L) is the unit of volume most commonly used. Equal in volume to a cubic decimeter (dm^3). A litre is slightly greater than a quart. A litre of pure water at a standard temperature and pressure has a mass of one kilogram.

METRE - The metre (m) is the basic unit of length. The metre is the length equal to 1 650 763.73 wavelengths in vacuum of the radiation corresponding to the transition between the levels $2p_{10}$ and $5d_5$ of the krypton - 86 atom. Or, slightly longer than a yard!

MILLIGRAM - (mg) Equal to one thousandth (0.001) of a gram (g). Used primarily in pharmaceutical and scientific work.

MILLILITRE - One thousandth (0.001) of a litre. Commonly used in scientific work and in the dispensing of drugs.

MILLIMETRE - (mm) One thousandth (0.001) of a metre. Approximately the thickness of a dime.

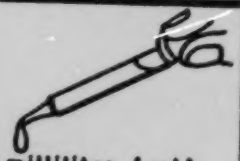
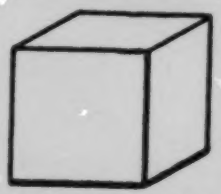
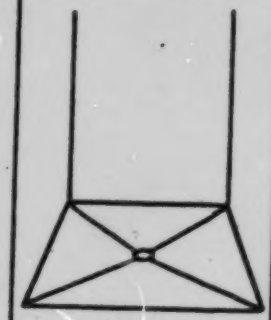
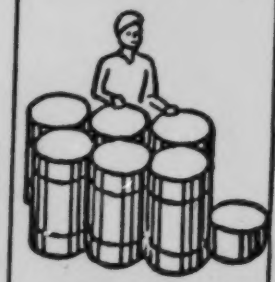
TON - The metric ton (t) is equal to 1000 kg and is used for shipping large quantities of product.

SI UNITS WITH SPECIAL NAMES

hertz (Hz)	The hertz is the number of repetitions of a regular occurrence in 1 second.
newton (N)	The newton is that force which, applied to a mass of 1 kilogram, gives it an acceleration of 1 metre per second squared.
pascal (Pa)	The pascal is the pressure produced by a force of 1 newton applied, uniformly distributed, over an area of 1 square metre.
joule (J)	The joule is the work done when the point of application of a force of 1 newton is displaced through a distance of 1 metre in the direction of the force.
watt (W)	The watt is the power which in 1 second gives rise to energy of 1 joule.
coulomb (C)	The coulomb is the quantity of electricity carried in 1 second by a current of 1 ampere.
volt (V)	The volt is the difference of electric potential between two points of a conducting wire carrying a constant current of 1 ampere, when the power dissipated between these points is equal to 1 watt.
ohm (Ω)	The ohm is the electrical resistance between two points of a conductor when a constant potential difference of 1 volt, applied to these points, produces in the conductor a current of 1 ampere, the conductor not being the seat of any electromotive force.
farad (F)	The farad is the capacitance of a capacitor between the plates of which there appears a difference of electric potential of 1 volt when it is charged by a quantity of electricity of 1 coulomb.

SI UNITS WITH SPECIAL NAMES (cont.)

weber (Wb)	The weber is the magnetic flux which, linking a circuit of 1 turn, would produce in it an electromotive force of 1 volt if it were reduced to zero at a uniform rate in 1 second.
henry (H)	The henry is the inductance of a closed circuit in which an electromotive force of 1 volt is produced when the electric current in the circuit varies uniformly at the rate of 1 ampere per second.
tesla (T)	The tesla is equal to 1 weber per square metre of circuit area.
lumen (lm)	The lumen is the luminous flux emitted within unit solid angle of 1 steradian by a point source having a uniform intensity of 1 candela.
lux (lx)	The lux is equal to an illuminance of 1 lumen per square metre.
siemens (S)	The siemens is the electric conductance of a conductor having an electric resistance of one ohm.
gray (Gy)	The gray is the unit of absorbed dose of radiation equal to one joule absorbed by one kilogram.
becquerel (Bq)	The becquerel is the unit of radioactivity equal to one disintegration per second.

LENGTH	AREA	VOLUME	LIQUID CAPACITY	WEIGHT(MASS) OF WATER
1 centimetre (cm)	1 square centimetre (cm^2)	1 cubic centimetre (cm^3)	 1 millilitre (ml)	1 gram (g)
1 decimetre (dm)	1 square decimetre (dm^2)	 1 cubic decimetre (dm^3)	1 litre (ℓ)	1 kilogram (kg)
1 metre (m)	 shower stall 1 square metre (m^2)	1 cubic metre (m^3)	 Each barrel contains 42 gallons or about 160 litres. 6.25 barrels of oil. 1 kilolitre (kl)	1 metric ton or tonne (t)

DISCUSSION QUESTIONS

The following questions are designed to serve as a guide in leading discussion about the metric system. They serve primarily to:

* stimulate inquiry and discussion within the group
* serve as independent study and research
* bring out differing points of view for debate, and
* introduce the teachers to different aspects of metrology and conversion to the metric system.

1. What are the major advantages of more widespread use of the metric system?
2. What are the disadvantages?
3. How do you feel about using the metric system?
4. What countries, other than the U.S., are not metric?
5. How might conversion affect foreign trade?
6. What are the basic differences between the metric system and the customary system of measurement?
7. What metric units are already in use in the U.S. and in what product lines are metric units common?
8. How will metric conversion affect consumer education?
9. What are some ways to facilitate the conversion?
10. What would be the most difficult adjustments for American people to make in converting to the metric system?
11. What segments of the economy stand to gain through metrication? Which will lose?
12. How might a working knowledge of metrics be an advantage in the job market? In what fields would it be most helpful?

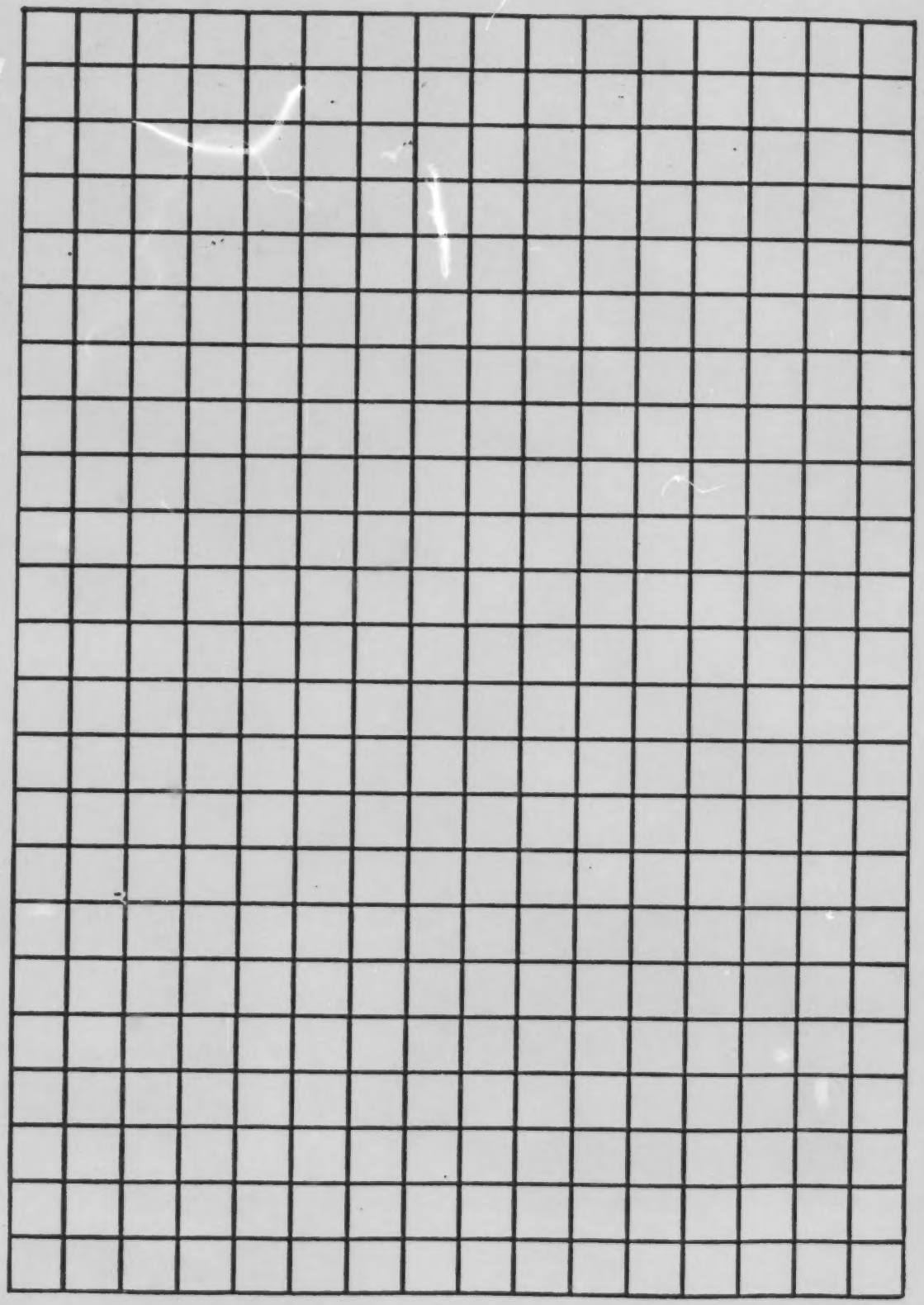
13. How would metrication affect. . .

- .running the home?
- ·shopping for food?
- ·buying home furnishings?
- ·buying clothing?
- ·traveling?
- ·manufacturing and servicing of autos?

14. Why has there been so much resistance to the metric system in the U.S.?

15. What are the benefits of using a uniform measuring system throughout the world?

"An Educator's Guide to Teaching Metrication", Sears, Roebuck, 1974.



Make your own meter ruler by cutting out the rulers on this page. Tape the rulers together in the right order.

Paste your meter ruler on cardboard

HEALTH OCCUPATIONS

In today's world, the use of several different measuring systems is not only inconvenient but could cause serious problems. This is especially true in the field of health where it is vitally important that medication standards and treatment be exact and accurate.

At present, five different systems of weights and measures are used to some extent in the field of health including:

(1) The apothecary system, historically used by physicians and pharmacists, for dispensing drugs.
(2) The avoirdupois system, for everyday activity, commonly referred to as the customary system.
(3) The household system, for determing dosages, which includes such familiar measures as the dropper, teaspoon, tablespoon and glass, a very loose measuring system due to differences in the sizes of these utensils.
(4) The traditional metric system which included the gram (g) for weight, (mass) the centimetre (cm) and metre (m) for linear measurement, the litre (l or ℓ) and mililitre (ml) expressed in "cc's" for liquid capacity or volume and the centigrade scale for temperature.
(5) The Sl metric system, a modernized version of the older metric system.

Practices When Using the Sl Metric System

With the introduction of the Sl metric system, certain traditional metric practices in the health field are incorrect and should be changed. These include the following:
(1) Referring to temperature as centigrade rather than the correct unit degrees Celsius (°C).
(2) Using the abbreviation cc or c.c instead of the correct term cubic centimetre (cm^3) for solids, or millilitre (ml) for liquids. In Sl metric, the letters cc stand for centi-centi-, which is meaningless. While pharmacists and others in the health field may continue to speak of so many "cc's" in conversation, it is extremely important that prescriptions be written with the correct symbols cm^3 or ml. In writing prescriptions in the metric system, it is very important to place a zero in front of the decimal point for all units less than one. For example, a dosage of five hundredths of a milligram should be written 0.05 mg. If the zero in front of the decimal point is omitted, it would read as .5 mg., which could be a serious error.
(3) Using the abbreviation "mcg" for microgram instead of the correct symbol µg.

In utilizing the metric system the following recommendations should be utilized.

Temperature: Clinical thermometers showing degrees Celsius should be used. Temperatures should be recorded in increments of tenths of a degree. The normal body temperature is 37^{o} Celsius. Some common reference temperatures are:

Low fever: 37.2^{o} C to 37.8^{o}C
38^{o}C is feverish
Mild fever: 37.9^{o}C to 39.4^{o}C
39^{o}C is very feverish
High fever: 39.5^{o}C to 40.6^{o}C
40^{o}C is dangerous

Human Measurement - Human measurements will be expressed in kilograms and centimetres. Body measurements should be marked in centimetres with subdivisions in millimetres. Weight should be expressed in kilograms.

HEIGHT AND WEIGHT

HEIGHT IN centimetres cm

WEIGHT IN kilograms kg

EXAMPLES

TALL HEAVY MAN		
Height	188	cm
Weight	95	kg
MEDIUM AVERAGE MAN		
Height	175	cm
Weight	74	kg
SMALL LIGHT MAN		
Height	164	cm
Weight	58	kg

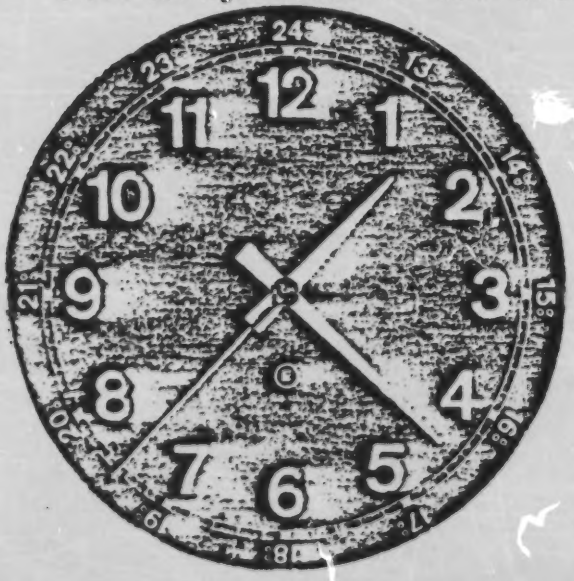
Diets: Diets should be given in kilojoules rather than the larger unit calories (kilocaries). Infants, for example, will require approximately 500 kJ per kilogram of body weight every 24 hours. An adult that previously required 2500 calories per day would be allowed 100 kJ per day.

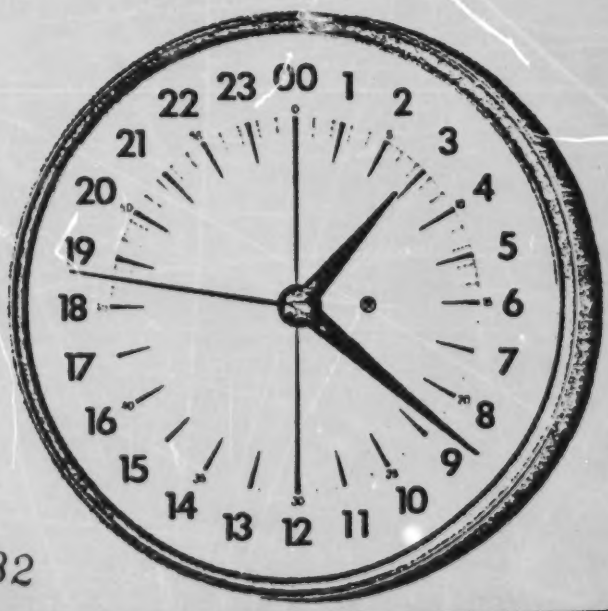
Pressure gages: The unit to measure pressure will be the kilopascal rather than pounds per square inch.

The 24-hour clock: The 24-hour clock is not unique to the metric system, but it is used in most countries where the metric system is in use. The military services have used the 24-hour clock for many years because it eliminates the a.m. and p.m. confusion. With the 24-hour clock system the day begins at midnight and ends at midnight 24 hours later. The hours, minutes and seconds are numbered continuously until 24 hours is reached. Instead of a day broken into two 12 hour parts the hours are numbered from 1 to 24. Some examples follow:

Conventional	24-Hour Clock
8:25 a.m.	8:25
12:00 noon	12:00
2:45 p.m.	14:45
6:00 p.m.	18:00
11:30 p.m.	23:30

The colon is used to separate minutes from hours. Two typical 24-hour clock configurations are shown below:





METRIC UNITS FOR NURSING

Quantity	Unit	Symbol	Use
Linear dimensions	centimetre	cm	Tracheotomy tube, orthopedic apparatus, anatomical part measurement, height/length of patient
	millimetre	mm	Anatomical measurement, dressings, iodoform packing, tubings, needle size, cardiac massage
Surface dimensions	square centimetre	cm^2	Surgical preparation, pharmaceutical ointment
Fluid flows	millilitres per minute	ml/min	Fluid consumption ratio–IV, irrigations, sump pump, gavages
Mass	milligram	mg	Pharmaceutical measurements
	gram	g	Dietary instruction, body mass, pharmaceutical measurements
	kilogram	kg	Body mass, orthopedic traction weight
*Volume and capacity	cubic centimetre	cm^3 (cc.)	I and O measurements, stock solutions, hypothermia unit, intramuscular injections, pharmaceutical measurements
	millilitre	ml	
	litre	l	Oxygen administration, I and O measurement, pharmaceutical measurement, IV
Temperature	degree Celsius	°C	Body temperature, baths, sterilizing
**Pressure	kilopascal	kPa	Oxygen flow, volume ventilation, hyperalimentation, central venous pressure, arteride blood gases

*Note: Medical symbol for cubic centimetre will probably remain cc. (cm^3). Also, cubic centimetre (cc.) and millilitre (ml) will be used interchangeably.

**The American National Metric Council is currently considering recommendations to measure body fluid pressures in kilopascals, but measuring pressure in mm/Hg will probably continue.

METRIC UNITS FOR LICENSED PRACTICAL NURSING

Quantity	Unit	Symbol	Use
Linear dimensions	centimetre	cm	Orthopedic apparatus, anatomical part measurement, height/length of patient
	millimetre	mm	Anatomical measurement, dressings, needle size, tubing
Surface dimensions	square centimetre	cm^2	Decubitus protective devices, pharmaceutical ointment
Fluid flows	millilitres per minute	ml/min	Fluid consumption ratio - IV, sump pump, specific irrigations
Mass	milligram	mg	Pharmaceutical measurements
	gram	g	Pharmaceutical measurements, body mass of children
	kilogram	kg	Body mass, orthopedic traction weights
*Volume and capacity	cubic centimetre	cm^3 (cc.)	I and O measurements, intramuscular injections, pharmaceutical measurements
	millilitre	ml	
	litre	l	I and O measurements, oxygen administration, IV
Temperature	degree Celsius	$^{\circ}C$	Body temperature, baths, sterilization
**Pressure	kilopascal	kPa	Central venous pressure, oxygen flow

*Note: Medical symbol for cubic centimetre will probably remain cc. (cm^3). Also, cubic centimetre (cc.) and millilitre (ml) will be used interchangeably.

**The American National Metric Council is currently considering recommendations to measure body fluid pressures in kilopascals, but measuring pressure in mm/hg will probably continue.

NURSING WITH METRICS

It is important to know what metric measurement to use. Show what measurement to use in the following situations.

1.	Capacity of a hot water bottle	
2.	Volume of bedside pitcher	
3.	P.O. fluid intake	
4.	IV solution	
5.	Length of traction ropes	
6.	Length and width of crutches	
7.	Length and width of foley catheter	
8.	Liquid medicine dosage	
9.	Mass of serving of meat	
10.	Amount of metamucil granules	
11.	Capacity of a juice glass	
12.	Mass of oral medication	
13.	Capacity of flask of 5% dextrose/water for an IV	
14.	Needle size for intramuscular injection	
15.	Capacity of tea cup	
16.	Temperature of dangerous fever	
17.		
18.		
19.		
20.		
21.		
22.		
23.		

THE CENTER FOR VOCATIONAL EDUCATION

nt to use. Show

17.	Amount of water in a tub	
18.	Temperature of water in an acquatic pad	
19.	Temperature of a hypothermia patient	
20.	Measure anatomical landmarks for an intramuscular injection	
21.	Record amount of fluid that patient takes	
22.	Pressure of normal gas range	
23.	Range of volume ventilation to maintain life functioning	

Metric Units for Nursing Aides

Quantity	Unit	Symbol	Use
Linear dimensions	centimetre	cm	Orthopedic ropes, anatomical part, height/length of patient
	millimetre	mm	Anatomical measurement, linens for bed protection
Surface dimensions	square centimetre	cm^2	Linens, chux/bed protectors
Fluid flows	millilitres per minute	ml/min	Article decontamination, foley drainage collection
Mass	gram	g	Body mass, food portions
	kilogram	kg	Body mass, orthopedic weights
*Volume and capacity	cubic centimetre	cm^3 (cc.)	I and O measurements, bodily secretions, dietary containers
	millilitre	ml	
	litre	l	I and O measurement
Temperature	degree Celsius	°C	Body temperature, baths, sterilization

*Note: Medical symbol for cubic centimetre will probably remain cc. (cm^3). Also, cubic centimetre (cc.) and millilitre (ml)will be used interchangeably.

Metric Units for Dental Assistant

Quantity	Unit	Symbol	Use
Length	millimetre	mm	X-ray slide; rubber dam; drill appliance; packing materials; length/diameter of molar root
	centimetre	cm	Sutures; dental tape and carbon
Area	square millimetre	mm^2	X-ray slide; surgical preparation
Fluid flows	millilitres per minute	ml/min	Oxygen and gas intakes; developing tank
Mass	milligram	mg	Pharmaceutical measurement; impression and base materials; crown cap material, i.e., gold
	gram	g	
	kilogram	kg	
*Volume and capacity	cubic centimetre	(cc.) cm^3	Injections; plaster; liquid application, i.e., topical fluoride; aseptics; impression materials, i.e., alginate; dental equipment.
	millilitre	ml	
	litre	l	
Temperature	degree Celsius	°C	X-ray development solution; room temperature
**Pressure	kilopascal	kPa	Steriliser; oral aspirator

*Note: Medical symbol for cubic centimetre will probably remain cc. (cm^3). Also, cubic centimetre (cc.) and millilitre (ml) will be used interchangeably.

**The American National Metric Council is currently considering recommendations to measure body fluid pressures in kilopascals.

METRIC ACTIVITIES

METRIC CURRICULUM PROJECT

Prepare a list of activities that could be used to introduce the metric system to the students in your occupational program. You should be able to identify at least 10 activities that would make learning the metric system both fun and interesting. You might consider such things as, using metric tools, producing learning packages, charts, bulletin board displays, etc. Try to make your activities relevant to your particular occupation area.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Body Facts

Materials: meter stick, metric tape measures

Directions: Complete the linear measurement portions of the Metric Measuring License. First estimate the length and then check your estimation using the tape measure.

Discuss the following questions with the rest of your group.

Do your estimates and actual measurements coincide? How close were you? Who in your group is the best metric estimator? Knowing these metric body facts could you now estimate metric lengths more accurately? Does knowing your metric body facts make it easier to THINK METRIC?

Metric Measuring License

This license entitles _____, upon completion of the form below, to be an OFFICIAL METRIC MEASURER, authorized to measure, at any time, using any OFFICIAL METRIC UNITS (such as cm, dm, m, km, g, or kg), ANYTHING that can be measured either with OFFICIAL MEASURING TOOLS or by ESTIMATION.

height_____ cm arm spread_____ cm nose to fingertip_____ cm elbow to fingertip_____ cm handspan_____ cm

palm_____ cm thumb_____ cm index finger_____ cm ring finger_____ cm pinkie_____ cm

knee to floor_____ cm foot length_____ cm foot width_____ cm shoe length_____ cm shoe width_____ cm

pixie step_____ cm giant step_____ cm most gigantic step_____ cm circumference of head_____ cm

circumference of neck_____ cm circumference of chest_____ cm circumference of wrist_____ cm circumference of waist_____ cm

circumference of thigh_____ cm circumference of ankle_____ cm weight_____ kg weight of shoe_____ g

weight of relaxed hand_____ g

age_____ years _____ _____

signature date

ALL OF THESE MEASUREMENTS WILL CHANGE–KEEP YOUR METRIC MEASURING LICENSE UP TO DATE

Copyright©1974 by Education Development Center, Inc. teachers may reproduce for use in their classrooms

CAPACITY MEASURE

Materials needed: metric measuring cups, full Coke bottle, empty Coke bottle, large container of unknown size (?), tea cup, drinking glass, source of water (sink).

Directions: To become familiar with the metric capacity of litre and millilitre complete the exercises below.

1. Fill the measuring cup with 100 ml. Pour this into the empty Coke bottle.

   Now estimate with your eye how many ml in the full Coke bottle?

   _____ml

2. To check your estimate, fill the empty Coke bottle until it is even with the full, capped bottle. Pour the water back into the measuring cup to measure the contents of the bottle.

   What are the actual contents of the Coke bottle? _____ml

3. In measuring typical servings, decide upon an amount which could be used in millilitres for the tea cup. Attempt to use whole numbers.

   _____ml = an average tea cup serving

4. In measuring typical servings, decide upon an amount which could be used in millilitres for the drinking water. Attempt to use whole numbers.

   _____ml = an average drinking glass serving

5. By visualizing what one litre "looks like," attempt to guess the contents in the large container marked "?".

   Write your guess here: _____ml

Now fill the large container and measure the contents._____ml, _____l. How far off was your guess? _____ml

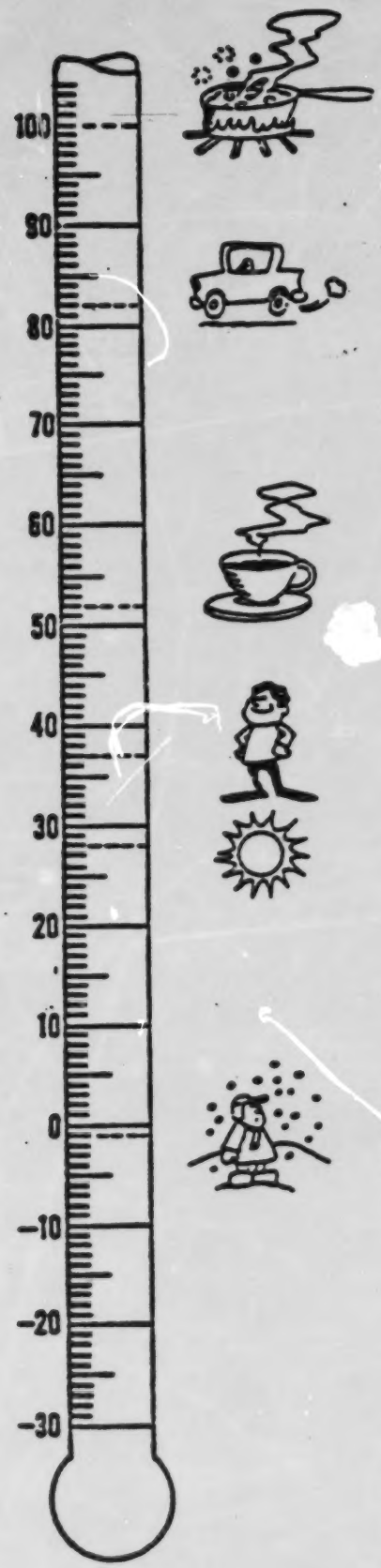
What's in a liter?

Materials: graduated containers or measuring beakers, household objects of varying capacity, e.g., teaspoon, coffee can, milk carton, juice cans, olive jars, cups, fruit jars, vases, etc., bucket, or other large container of water.

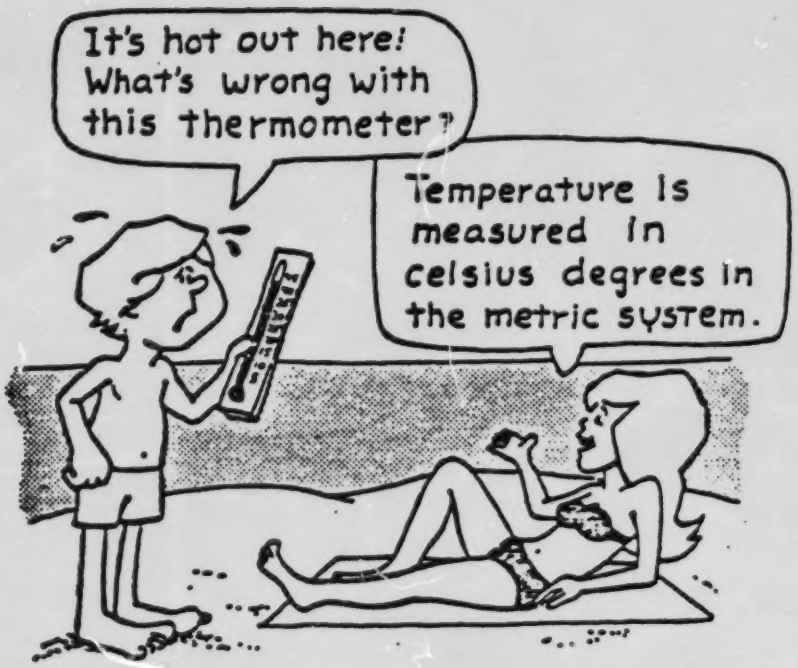
Participants will estimate and then measure the amount of water each container can hold by using the measuring beakers. Liquid volume of the smaller containers can more easily be found by first filling the container with water and then pouring its contents into the appropriate graduated cylinder.

After sufficient measurement exercises students will be challenged to estimate the capacity of bottles having different shapes, but not readily identifiable capacity.

Container	Estimated Volume	Actual Volume
A		
B		
C		
D		
E		
F		
G		



Celsius temperature will be easy to use after some reference points are established. The freezing point of water is $0^{o}C$. Boiling point is $100^{o}C$. A comfortable room temperature is $20^{o}C$ to $22^{o}C$ and human body temperature is $37^{o}C$. Complete the chart below.



cartoon beside thermometer	estimated temperature
summer day	°C
snowy day	°C
water will boil	°C
car radiator	°C
drinkable coffee	°C

SMALL DISTANCES

This exercise can help you to become accurate in estimating lengths under 300 millimeters. You'll need a millimeter ruler and a large sheet of paper. Follow these instructions very carefully:

(a) Without looking at the ruler, draw a line that you think is equal to the line specified under "Length" in the score sheet. Start with Group A, Trial 1.

(b) Measure your line with a ruler and enter this length under the column "Your Score" on the score sheet. Follow the same procedure for the other four trials of Group A.

(c) At the end of the five trials of Group A, add up your scores and subtract your total from the correct total given on the score sheet. Enter this difference on the score sheet.

(d) Repeat this process for additional groups of five trials each until you are satisfied with your accuracy.

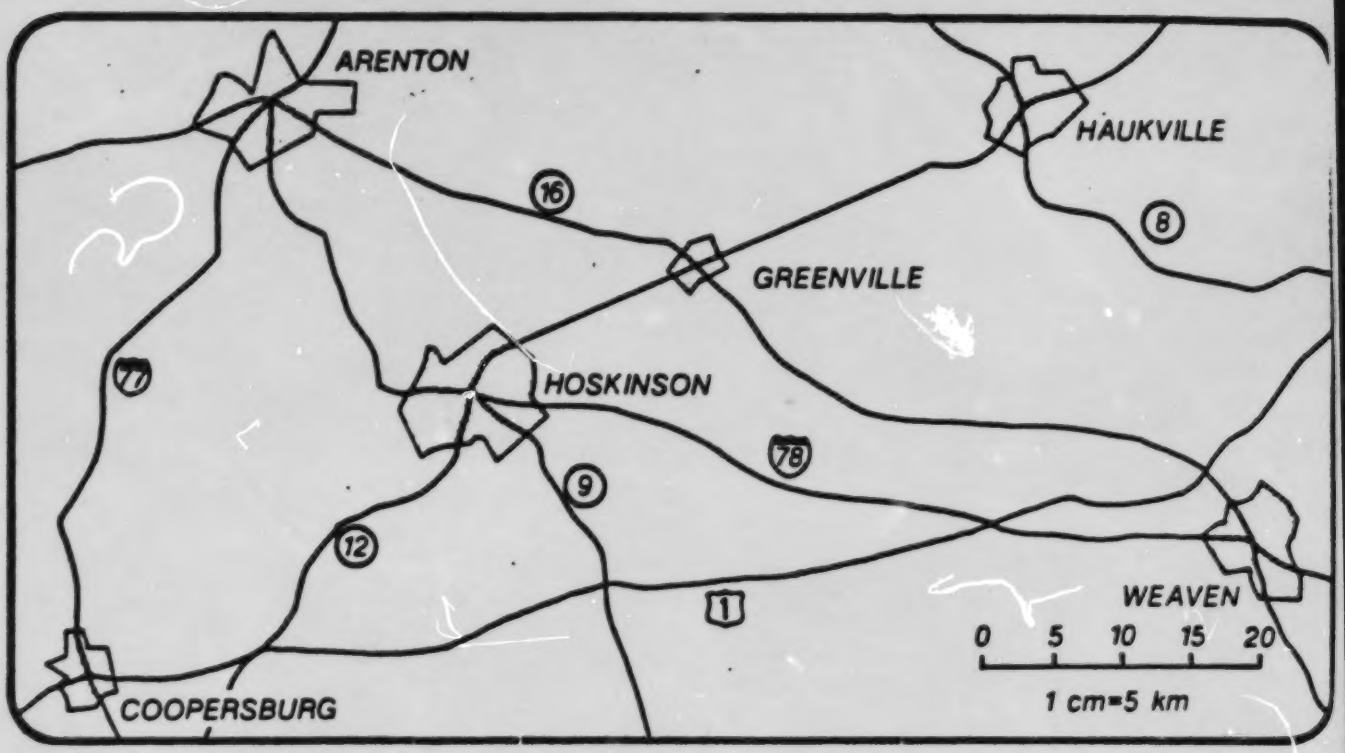
Remember, don't look at the ruler when you draw the lines.

SCORE SHEET

	Trial	Length (mm)	Your Score		Trial	Length (mm)	Your Score
(A)	1	1		(B)	1	213	
	2	130			2	84	
	3	85			3	151	
	4	7			4	3	
	5	260			5	112	
	Total	483			Total	563	
	Difference				Difference		
(C)	1	96		(D)	1	120	
	2	13			2	235	
	3	176			3	35	
	4	34			4	166	
	5	3			5	8	
	Total	322			Total	564	
	Difference				Difference		
(E)	1	62		(F)	1	147	
	2	181			2	9	
	3	4			3	190	
	4	221			4	51	
	5	106			5	73	
	Total	574			Total	470	
	Difference				Difference		

Look at the map below. The scale of the map is 1 cm = 5 km. You are to:

a. Estimate the distances between towns (center to center)
b. Measure the distances with your ruler and figure the number of kilometers.
c. Estimate the approximate travel time at 90 km/h.



	Distance (a) Estimated	Distance (b) Measured	(c) Travel Time at 90 km/h
1. Arenton to Weaven via Hwy 16	_____ km	_____ km	_____ h
2. Arenton to Weaven via Hwy 78	_____	_____	_____
3. Weaven to Coopersburg	_____	_____	_____
4. Coopersburg to Hoskinson	_____	_____	_____
5. Weaven to Haukville via 16 and 12	_____	_____	_____

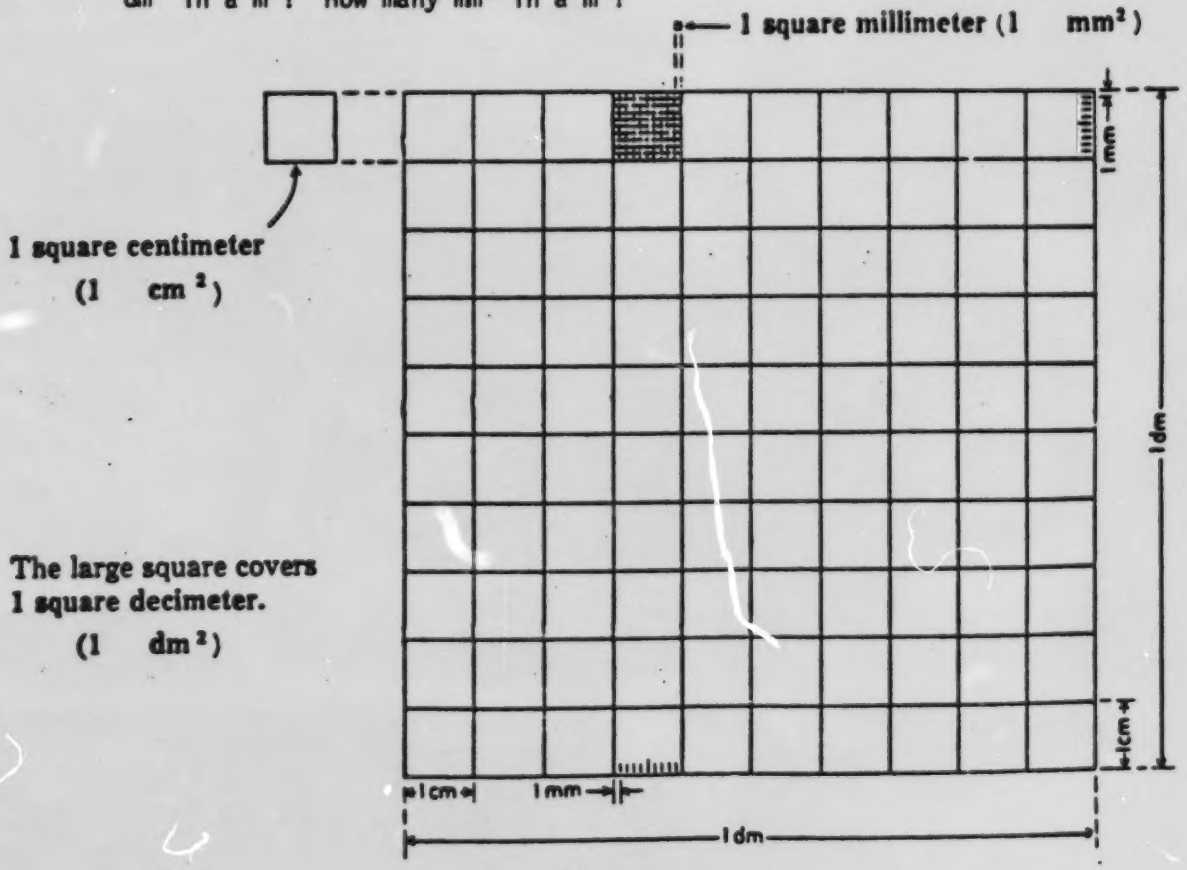
Square Metre

Materials: meter stick, newspapers, tape and/or stapler, centimetre/millimetre grid paper.

Directions: Measure off and then cut out a square meter. Two large sheets of newspaper taped together will provide more than enough area.

Using the square metre as a guide estimate the size of various large objects in the room (table top, windows, door, floor, chalk board, etc.). Now measure these objects.

Study the centimetre/millimetre grid paper. Identify the mm^2 and $cm.^2$. How many mm^2 in a cm^2? How many cm^2 in a dm^2? How many dm^2 in a m^2? How many mm^2 in a m^2?



MIX AND MATCH PUZZLE
(Linear Measure)

On the next page you will see the sheet you are going to work on.

Cut the squares on this page apart. You are going to arrange these squares on the next page so that every measurement *has the same value* as the measurement adjacent (right next) to it. See the example below. When you are sure your solution to the puzzle is correct, paste or tape your squares down.

57 km .01 m 4 m .23 km	.23 mm 4 mm 400 m 5.7 km	.057 km 1000 cm 40 mm 230 dm	570 mm 10 cm .4 mm 230 mm
5.7 m .01 m .4 cm 57 mm	.023 hm 400 cm .1 cm 5.7 mm	230 cm 1 m 400 mm 23 cm	23 m 4 cm 10 dm 57 cm
230 m 400 km 4000 m 57 dm	5700 m .04 m 10 dm .057 cm	2.3 dm 1 mm 4 mm 57 m	23 cm .4 m .04 mm 570 km
5.7 cm .1 mm 40 mm 230 km	.57 cm 4 km 10 m 2.3 cm	23 m .4 km 1 dm 2300 mm	.057 mm .4 cm .01 mm .023 km

Example:

.4 cm	4 mm 400 m	.4 km
	5.7 km	
	5700 m	

SOLUTION to MIX and MATCH PUZZLE

57 km .01 m 4 m .23 km			

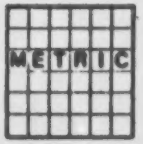
FUN WITH METRICS

Metric Mumble

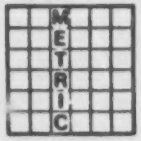
B	H	F	H	Y	D	N	K
K	L	D	E	D	E	C	I
C	M	I	C	X	K	S	L
C	E	N	T	I	A	W	O
D	T	L	O	E	M	P	V
Z	E	L	S	G	R	A	M
G	R	J	M	I	L	L	I
P	S	X	N	G	U	T	V
W	B	G	F	O	R	S	T

Find 10 metric terms in this mumble. Circle each term you find. They are:

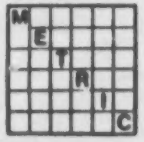
left to right



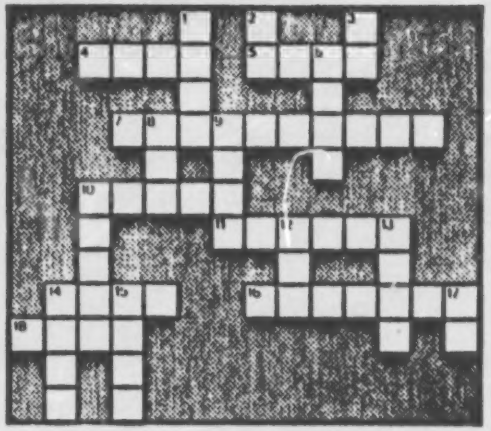
up and down



or angled



Metric Crossword Puzzle



Across

4. This metric prefix represents X 1000.
5. Use this metric unit to measure mass or weight.
7. Speed limits may soon appear in both miles and this unit.
10. A girl's name but also the prefix 1/1000 in the metric system.
11. An industry that wasn't short sighted when it came to metrics.
14. The prefix representing 1/10 of a meter, liter, or gram.
16. A mercurial messenger—the metric scale for temperature.
18. Necessary temperature for a snow fall.

Down

1. At 100 °C water is likely to_____.
2. The symbol for the metric measurement you might find on a package of meat.
3. Write the symbol for 1/1000 of a meter and you'll have this answer.
6. An industry racing to the metric challenge.
8. This word would describe your condition if your body registered 40 °C.
9. The state that initiated the dual measurement look on its highways.
10. A little longer than a yard is a good description for this metric unit.
12. Legend has it that the length from heel to _____ of some king may have established our customary foot.
13. Uphill or downhill, manufacturers of this sports equipment have already gone metric.
14. This metric prefix represents X 10.
15. Describe the weather at 5°C.
17. Abbreviation for the international metric system.

Metric Activities

- Become involved! Encourage others to get into the metric swing. Construct posters, wall hangings, mobiles, etc. displaying metric information. Naturally, use metric measurements.
- Run a contest in your community or school. Have people guess the weight of a jar of coins, a sack of peanuts, or the volume of a jug of water in metric measurements.
- For a long-term project, set up a weather watch recording the temperature in degree Celsius. With changes of weather and season, you'll learn the Celsius scale.

© 1974 J.C. Penney Company, Inc. Educational Relations Department Fall/Winter

METRIC COMPETITION - AN OLYMPICS OF UNDERSTANDING

The following activities are designed primarily as "ice breakers" to encourage group interaction. All workshop participants will be expected to participate in the group activities to share in the learning experience. The activities are for fun and learning. Teachers are encouraged to adapt the activities for their own classroom use.

SQUASH

Supplies: Balls of clay of equal mass (3 to 5 cm in diameter), centimeter grid paper. Divide into teams. Select a volunteer from each team. Volunteers should remove jewelry and watches from "squashing" hand. Place the clay ball in the center of the grid paper. Each contestant is to hit the ball one time with their hand (fist or open hand is ok), striving to spread the clay ball over the largest possible area. Pressing or leaning on the ball is illegal - one "squash" per ball. Don't miss the ball! In measuring the area, partial squares are counted as complete squares. Remold your ball and repeat with another volunteer. Add individual scores for team score. The largest covered area wins.

FIREMAN

Supplies: Container of water, eyedroppers, metric graduated cylinders or beakers, paper towels.

Divide into teams. Team members are to transfer water from a large container on one side of the room to smaller graduated containers on the other side of the room in a specified period of time. Winners are

those with the most water in their graduated containers. The floor may become wet and slippery so be careful.

ROCKET

Supplies: Wrapped soda straws, a metric tape measure.

Divide into teams. Each contestant will mark the straw wrapper so they can identify their own. Remove one end of the wrapper. When given the word, all contestants will blow through the straw and "rocket" the wrapper as far as they can. The straight line distance is measured, added for each team, and the greatest measure is the winner.

JAVELIN - a version of ROCKET

Supplies: Soda straws, a metric tape measure.

This time toss the straws, running starts not allowed, like a javelin and measure the distance.

MASSIVE

Supplies: None

Divide into teams and select one volunteer from each group. The volunteers will come to the front of the room and stand as a group. The remaining team members will estimate the collective mass of the volunteers, in kilograms. Closest estimate wins. (Since most volunteers will know their mass in pounds simply add their mass and convert this combined figure into kilograms).

STUFF-A-METER

Supplies needed: Metre stick, or tape, chalk.

Divide the class into two groups. Mark two square metres on the

floor, leave about two metres space between. The object of this game is to fit as many people as possible into the square. All contestants must have both feet on the floor, inside the square - arms and bodies may hang over the side. Winning team is the one with most people in the square metre.

PIN-UP

Supplies: Metric tape measures, chalk.

Divide into teams. Select a volunteer who will have his/her measurements (bust, waist, hips) measured by the rest of the group. Draw a cartoon figure on the board and label BWH on the figure to correspond to the measurements of the volunteer. Class will vote on the "best" combination.

THE LONG AND SHORT OF IT

Supplies: Chalk, metric tape measures.

Divide into teams. Measure the height of each person in the group. Add these heights for a group score. Tallest and shortest combined score are winners.

HOT 'N COLD

Supplies: Containers for water, ice, metric thermometer.

Divide into groups. Groups will estimate the temperature of a container of tap water and one of ice water. Closest estimates win.

FEET 'N MORE FEET

Supplies: Metric tape measure.

Divide into teams. Have each member stand foot-to-foot each person in a row. Measure the length of feet in meters (no pun intended). Longest, or shortest, measurements wins.

ACTIVITIES AND DISPLAYS TO PROMOTE STUDENT UNDERSTANDING

ORGANIZE A METRIC INFORMATION CENTER

Collect metric catalogs, articles, pamphlets and books to serve as reference materials. Set up a metric resource center in your classroom or library.

METRIC MEASUREMENT DISPLAY

Set up a display of metric and customary measuring tools to illustrate the relationships and differences between them.

METRIC PRODUCT DISPLAY

Select common everyday products, i.e., canned goods, soda bottles, other grocery products that are labeled in metric and customary measure. Illustrate the difference between "hard" and "soft" conversion.

METRIC TOOL DISPLAY

Set up a display of metric and customary tools used by the craftsman/woman in your specific trade.

METRIC TEMPERATURES

Discuss Celsius with your students. Encourage them to think metric by discussing common temperatures in degrees Celsius.

For example:

Water boils at 100°C

Body temperature is 37°C

Water freezes at 0°C

Discuss whether 25°C would be beach or snow skiing weather. Discuss the merits of the metric system.

MAPREADING

Glue a road map to cardboard. Design and construct a kilometre ruler (must be the same scale as the map - consult the legend) that is long enough to reach any place on the map. Attach the ruler to the map so that it is moveable. Locate the origin (o) on a major city (i.e., Miami) so that students can measure a straight line distance to other cities. Make a list of cities and encourage students to determine the number kilometres to these cities.

VOLUME MEASURE

Glue centimetre grid paper all over a cigar box, small shoe box and other small boxes. Have the children estimate then actually determine the volume of the boxes.

METRIC FASTENERS

Display various metric and customary fasteners, nuts, bolts, etc., and the tools used to fasten them. Allow the students to compare the metric and customary fasteners and tools to determine the subtle differences. Discuss why the tools and fasteners are not interchangeable.

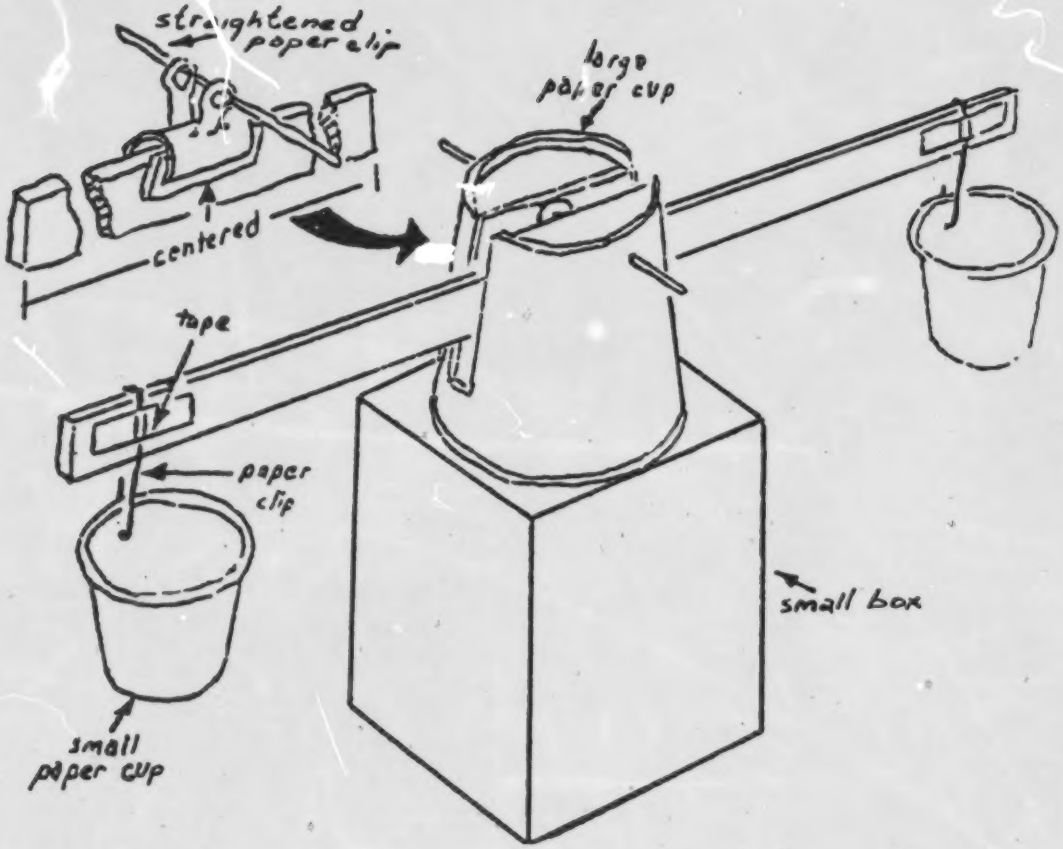
METRIC SHOPPING

Have students look for metric materials in their homes or as they shop. Have them bring empty containers and other metrically marked materials to class. A contest could be made out of this exercise by dividing the class into groups and having them seek varied items.

The gram is the basic unit of weight in the metric system.

A nickel weighs 5 grams.
A penny weighs 3.11 grams.
8 common straight pins weigh about 1 gram.

A balance scale



Use a balance scale to compare the weights of these objects.

1. How many paper clips weigh just about as much as a nickel?
   About how much does a paper clip weigh?

2. About how much notebook paper weighs just as much as a nickel?
   (Hint: Use pieces with an area of 100 square centimeters.)
   About how much does a square centimeter of notebook paper weigh?

ARE YOU READY FOR METRICS? (PRE-TEST)

Please fill in the correct answers:

1. 1 ounce = _____tablespoon(s)
2. 4 ounces = _____gill(s)
3. 16 tablespoons = _____cup(s)
4. 32 ounces = _____quart(s)
5. 105 quarts - _____barrel(s)
6. 1 cord = _____cubic foot/feet
7. 4 pecks = _____bushel(s)
8. 1 bushel = _____quart(s)
9. 1 peck = _____quart(s)
10. 1 ton = _____pound(s)
11. 16 ounces = _____pound(s)
12. 1 dram = _____grain(s)
13. 12 inches = _____foot/feet
14. 1 rod = _____foot/feet
15. _____feet = 1 mile
16. _____yards = 1 mile
17. _____rods = 1 mile
18. _____cubic foot/feet = 1 cubic yard

Correct your answers to the Pre-test:

1. 2 tablespoons
2. 1 gill
3. 1 cup
4. 1 quart
5. 1 barrel
6. 128 cubic feet
7. 1 bushel
8. 32 quarts
9. 8 quarts
10. 2000 pounds
11. 1 pound
12. 24 grains
13. 1 foot
14. 16 1/2 feet
15. 5280 feet
16. 1760 yards
17. 320 rods
18. 27 cubic feet

Scoring:

18 - 16 correct:	CONGRATULATIONS! You really know the customary system, but you'd better get ready for the metric system anyway. It's coming!
15 - 11 correct:	PRETTY GOOD! It may be difficult to adjust, but you have only about one-half of what you already know to forget!
10 - 0 correct:	LUCKY YOU! You have almost nothing to unlearn. you'll love the metric system!

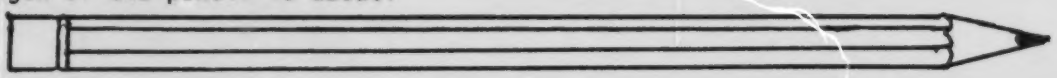
Source unknown.

METRIC SYSTEM PRE-POST-TEST

1. A metre is equal to:

   A) 10 centimetres
   B) 100 centimetres
   C) 1 000 millimetres
   D) both A and C
   E) both B and C

2. The length of the pencil is about:

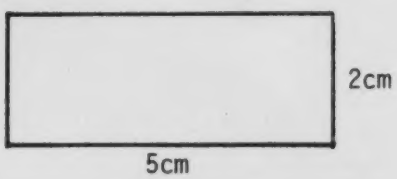


   F) 15 millimetres
   G) 15 centimetres
   H) 15 decimetres
   J) 15 metres

3. The symbol for kilometre is:

   A) KM
   B) km.
   C) km
   D) Km
   E) Km.

4. The area of the rectangle shown is:

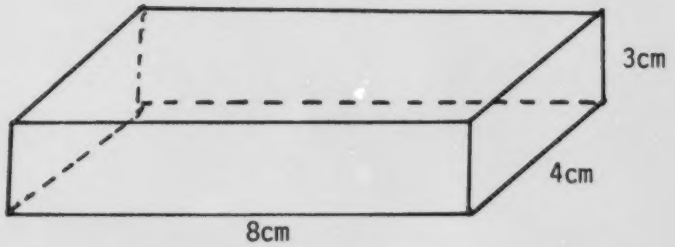


   F) 10 square centimetres
   G) 100 square millimetres
   H) 14 centimetres
   J) 1.4 decimetres
   K) both F and G

5. One square metre is equal to:

   A) 10 square decimetres
   B) 1 000 square decimetres
   C) 100 square centimetres
   D) 10 000 square centimetres
   E) both A and C

6. The volume of the box shown is:



   F) 0.96 cubic metres
   G) 9.6 cubic metres
   H) 9.6 cubic centimetres
   J) 96 cubic centimetres
   K) both F and J

Not to scale.

7. One litre is equal to:

A) 1 cubic decimetre
B) 10 cubic centimetres
C) 100 cubic centimetres
D) 1 000 cubic centimetres
E) both A and D

8. One metric cup is equal to:

F) 100 millilitres
G) 250 millilitres
H) 500 millilitres
J) 750 millilitres

9. Water freezes at ____ ^{o}C

A) -32
B) -10
C) 0
D) 10
E) None of the above

10. The kilogram is used to measure:

F) length
G) volume
H) capacity
J) mass

11. A ton (tonne) is equal to:

A) 1 000
B) 2 000 kilograms
C) 1 000 grams
D) 2 000 grams
E) none of the above

12. A newton is equal to ____kilonewtons

F) 1 000
G) 100
H) 0.01
J) 0.001
K) none of the above

13. 23 m = _____km

A) 230
B) 0.23
C) 23 000
D) 0.023
E) none of the above

14. The prefix hecto means:

F) 0.01
G) 0.1
H) 10
J) 100
K) none of the above

15. 15 cm^2 = ____mm^2

A) 15 000 000
B) 0.15
C) 15 000
D) 0.015
E) none of the above

16. Comfortable room temperature might be:

F) 5^{o}C
G) 25^{o}C
H) 55^{o}C
J) 75^{o}C
K) none of the above

17. Which represents the largest area?

A) 30 hectares
B) 300 $ares_2$
C) 3 000 cm^2
D) 30 000 cm^2

18. A roast might weigh:

F) 5 mg
G) 500 g
H) 3 kg
J) 20 kg

19. The capacity of a car's gasoline tank might be:

A) 60 ℓ
B) 6 ℓ
C) 0.6 mℓ
D) 600 mℓ

20. The symbol for the prefix mega is:

F) m
G) Mg
H) M
J) ✗
K) none of the above

OVERHEAD TRANSPARENCIES

CONVERTING FEET TO METERS

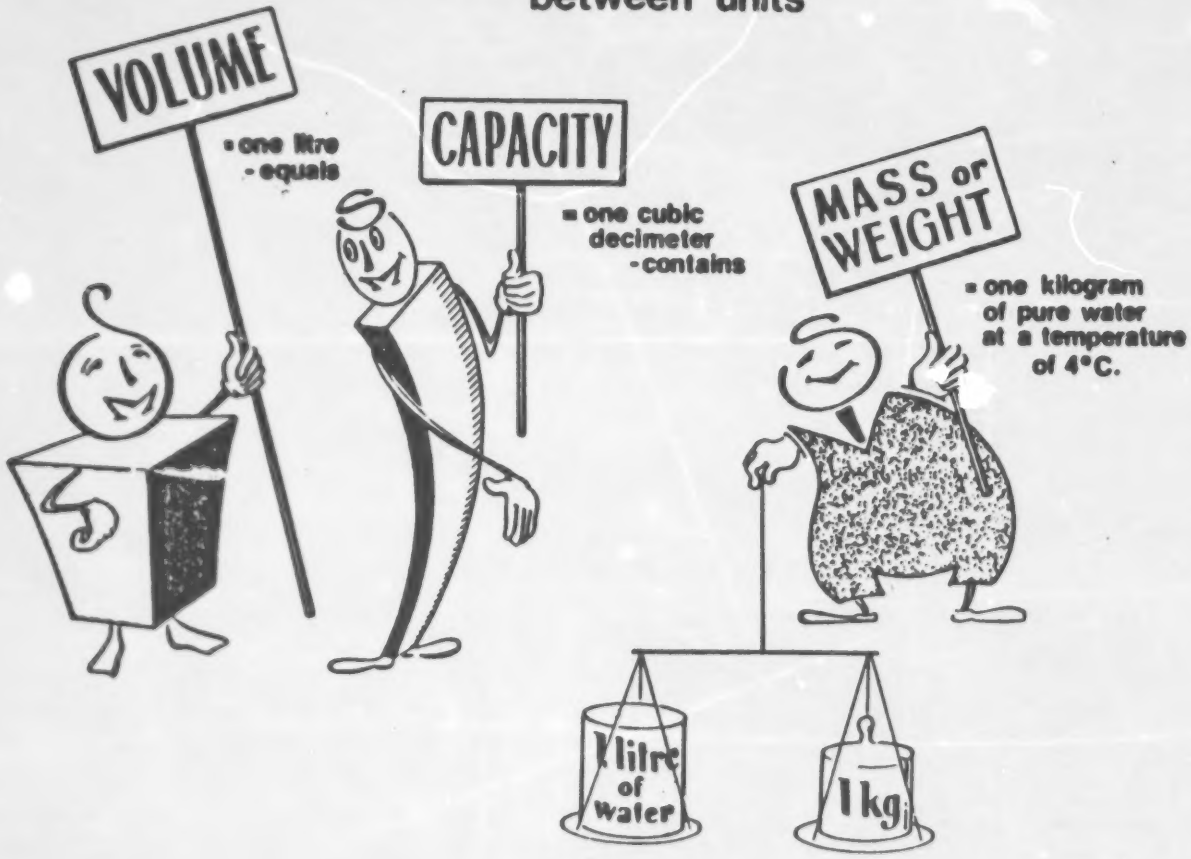
INTERNATIONAL SYSTEM OF UNITS (SI)

Seven Base Units

1. Metre: Unit of length
2. Kilogram: Unit of mass
3. Second: Unit of time
4. Ampere: Unit of electric current
5. Celsius: Unit of temperature
6. Candela: Unit of luminous intensity
7. Mole: Unit of amount of substance

USOE SPONSORED PROJECT NO. V237006
GRANT NO. OEG-0-72-1868

In the metric system
there is a definite relationship between units



USOE SPONSORED PROJECT NO V257006
GRANT NO OEG-0-72-1868

Length is a measure of distance.

METRIC

1 kilometer = 1000 meters
1 hectometer = 100 meters
1 dekameter = 10 meters
1 meter = 1 meter
1 decimeter = 0.1 meter
1 centimeter = 0.01 meter
1 millimeter = 0.001 meter

1000 millimeters = 1 meter
100 centimeters = 1 meter
1000 meters = 1 kilometer

CUSTOMARY

12 inches = 1 foot
3 feet = 1 yard
36 inches = 1 yard
5280 feet = 1 mile

Volume is a measure of space occupied.

METRIC

1 hectoliter = 100 liters

1 dekaliter = 10 liters

1 liter = 1 liter

1 deciliter = 0.1 liter

1 centiliter = 0.01 liter

1 milliliter = 0.001 liter

1000 milliliters = 1 liter

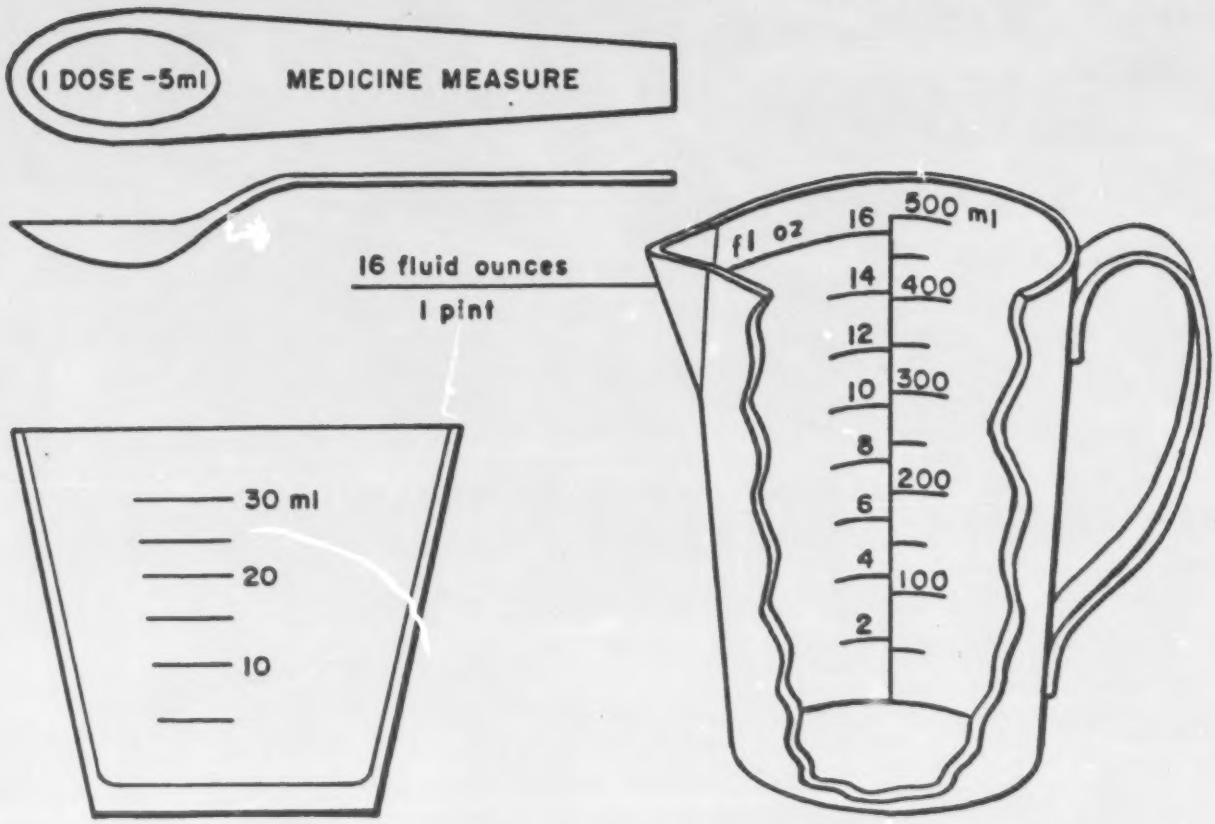
CUSTOMARY

2 cups = 1 pint

2 pints = 1 quart

4 quarts = 1 gallon

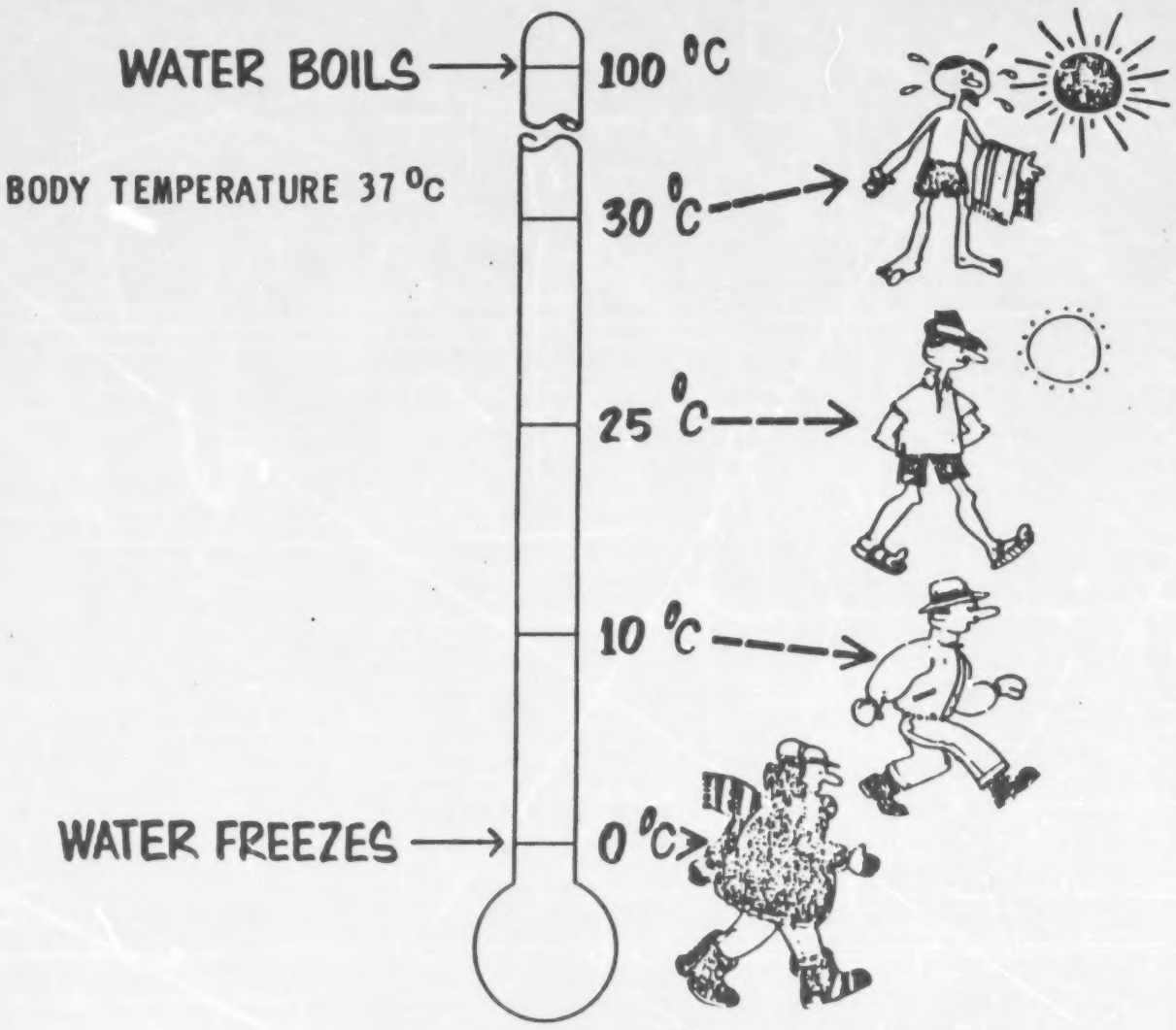
8 pints = 1 gallon


1 DOSE - 5ml
MEDICINE MEASURE
16 fluid ounces
1 pint
30 ml
20
10
fl oz
16
14
12
10
8
6
4
2
500 ml
400
300
200
100

Temperature is a measure of hotness or coldness.

METRIC		FAHRENHEIT
0°C	freezing point of water	32°F
10°C	a warm winter day	50°F
20°C	a mild spring day	68°F
30°C	quite warm--almost hot	86°F
37°C	normal body temperature	98.6°F
40°C	heat wave	104°F
100°C	boiling point of water	212°F

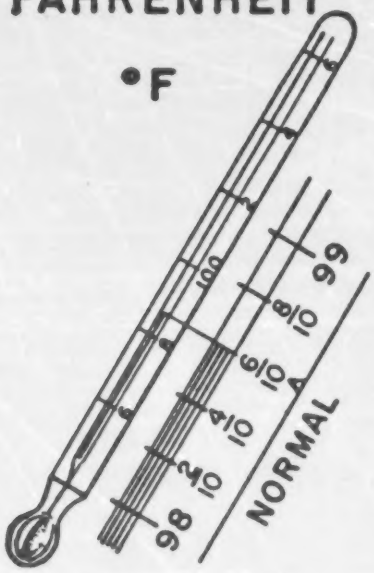
METRIC TEMPERATURE (DEGREE CELSIUS)



THERMOMETER SCALES

FAHRENHEIT

°F



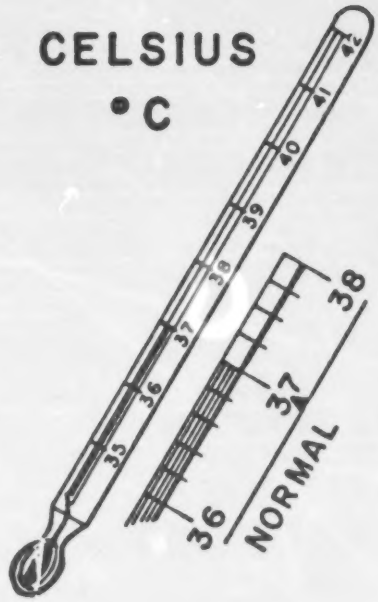
TO CONVERT FAHRENHEIT TO DEGREES CELSIUS, SUBTRACT 32 & MULTIPLY BY 5/9.

FAHRENHEIT CELSIUS CONVERSION TABLE

°F	°C
111.2	44.0
109.4	43.0
107.6	42.0
105.8	41.0
104.0	40.0
102.2	39.0
101.3	38.5
100.4	38.0
99.5	37.5
98.6	37.0
97.7	36.5
96.8	36.0
95.0	35.0
93.2	34.0

CELSIUS

°C



TO CONVERT DEGREES CELSIUS TO FAHRENHEIT, MULTIPLY BY 9/5 AND ADD 32.

PEANUTS **By Schulz**

THERE ARE TEN MILLIMETERS IN ONE CENTIMETER...ONE HUNDRED CENTIMETERS IN ONE METER AND ONE THOUSAND METERS IN ONE KILOMETER...
11-17
I CAN'T REMEMBER ALL THAT! WHAT ARE THEY TRYING TO DO TO US?!
I JUST GOT INCHES AND FEET FIGURED OUT, MARCIE.. NOW, THEY THROW METRICS AT US! I'LL GO CRAZY!
YOU'LL CATCH ON BEFORE YOU KNOW IT, SIR...
SOMEBODY'S ALWAYS TRYING TO CHANGE THINGS!
IT'S THOSE PEOPLE ON THE SCHOOL BOARD! THEY ALWAYS GET CARRIED AWAY...
GIVE THEM A MILLIMETER AND THEY TAKE A KILOMETER!
SEE? YOU'RE CATCHING ON, SIR!

89

BIBLIOGRAPHY OF METRIC INFORMATION

INDEX OF METRIC INFORMATION SOURCES

The following information is provided by:

National Council of Teachers of Mathematics

1906 Association Drive, Reston, Va. 22091

(December 1978)

and is duplicated here with permission.

INDEX

BOOKS, WORKBOOKS & POSTERS. 71

MANIPULATIVE AIDS & KITS. 74

FILMS & FILMSTRIPS. 77

FILMLOOPS & VIDEO-CASSETTES 79

SLIDES & TRANSPARENCIES 79

AUDIO-CASSETTES & RECORDS 80

PERIODICALS & REPORTS AND PAMPHLETS 81

GAMES 82

DUPLICATING MASTERS 82

CODES

LEVELS

E = Elementary I = Intermediate S = Secondary

P = Post-Secondary & Other

TITLE CATEGORIES

Category 1 = Line 1 Category 2 = Line 2 Category 3 = Line 3

BOOKS[1], WORKBOOKS[2], & POSTERS[3]

Action Math Associates, Inc	- - - -[1]	
1358 Dalton Dr	E I S [2]	
Eugene, OR 97404	- - - -[3]	
Activity Resources Co, Inc	E I S	
Box 4875	E I S	
Hayward, CA 94540	- - - -	
Addison-Wesley (Canada) Ltd	E I S	
36 Prince Andrew Place	E I	
Don Mills, ON M3C 2T8	- - - -	
Addison-Wesley Publishing Co	E I	
2727 Sand Hill Rd	I	
Menlo Park, CA 94025	- - - -	
Allyn & Bacon, Inc	E I	
470 Altantic Ave	E I S P	
Boston, MA 02210	- - - -	
American Book Co	E I S	
450 West 33d St	E I S	
New York, NY 10001	E	
American Dairy Queen Corp	- - - -	
PO Box 14312	- - - -	
Dayton, OH 45414	E I	
American Educational Films	- - - -	
132 Lasky Drive	S P	
Beverly Hills, CA 90212	- - - -	
American Home Economics Assoc	I S P	
2010 Massachusetts Ave, NW	- - - -	
Washington, DC 20036	- - - -	
American National Metric Council	E I S P	
1625 Massachusetts Ave, NW	- - - -	
Washington, DC 20036	E I S P	
American Natl Standards Institute	- - - -	
1430 Broadway	- - - -	
New York, NY 10018	E I S P	
Ann Arbor Publishers, Inc	I S P	
PO Box 388	- - - -	
Worthington, OH 43085	- - - -	
Baker & Taylor Co	E I S	
6 Kirby Ave	- - - -	
Somerville, NJ 08876	E I S	
A Ballu & Company	- - - -	
2078 Integrity Drive N	- - - -	
Columbus, OH 43209	E I	
Barron's Educational Series, Inc	I S	
113 Crossways Park Dr	I S	
Woodbury, NY 11797	I S	
Rita Brey	E	
18750 Five Points	- - - -	
Detroit, MI 48240	- - - -	
Brooks/Cole Publishing Co	P	
540 Abrego St	- - - -	
Monterey, CA 93940	- - - -	
Burgundy Press	S P	
P.O. Box 313	S P	
Southampton, PA 18966	I S P	
California State Dept of Educ	- - - -	
721 Capitol Mall	E I	
Sacramento, CA 95616	E I	
Calligraphic Concepts	- - - -	
6505 Windsor Island Road N	- - - -	
Salem, OR 97303	E I S P	
The Ctr for Open Learning	E I S	
& Teaching Inc/PO Box 9434	- - - -	
Berkeley, CA 94709	- - - -	
Center for Vocational Education	P	
Ohio State Univ/1960 Kenny Road	P	
Columbus, OH 43210	- - - -	
The Child's World	E	
1556 Weatherstone La/PO Box 681	- - - -	
Elgin, IL 60120	- - - -	
Clearvue, Inc	I S P	
6666 No Oliphant Ave	I S P	
Chicago, IL 60631	- - - -	
Collier Macmillan Canada Ltd	E I	
1125 B Leslie St	- - - -	
Don Mills, ON M3C 2K2	- - - -	
The Continental Press, Inc	- - - -	
520 E. Bainbridge St	E I S	
Elizabethtown, PA 17022	- - - -	
Copp Clark Publishing	E I S	
517 Wellington Street West	E	
Toronto, ON M5V 1G1	- - - -	
Creative Associates	S P	
PO Box 2207/8001 Cameo Drive	- - - -	
Rockford, IL 61111	- - - -	
Creative Publications, Inc	E I S	
PO Box 10328	E I S	
Palo Alto, CA 94303	E I S	
Creative Teaching Associates	- - - -	
P.O. Box 7766	E	
Fresno, CA 93727	- - - -	
Crestwood House Inc	E	
PO Box 423	- - - -	
Mankato, MN 56001	- - - -	
Thomas Y. Crowell Company	E I	
10 East 53d Street	- - - -	
New York, NY 10022	- - - -	
Cuisenaire Co of America, Inc	E I	
12 Church Street	E I	
New Rochelle, NY 10805	- - - -	
Damon/Educational Division	E I	
80 Wilson Way	E I	
Westwood, MA 02090	- - - -	
Delma Publishers	- - - -	
50 Wolf Road	I S P	
Albany, NY 12205	- - - -	
Denoyer-Geppert Company	- - - -	
5235 Ravenswood Avenue	- - - -	
Chicago, IL 60640	E	
Developmental Learning Materials	- - - -	
7440 Natchez	E I	
Niles, IL 60648	- - - -	
Dick Blick Company	- - - -	
PO Box 1267	E I	
Galesburg, IL 61401	E I S	

Dixie/Marathon Prod	- - - -
Div Amer Can Co/One American Lane	- - - -
Greenwich, CT 06830	E I
Doubleday & Company, Inc	- - - -
501 Franklin Avenue	E I S
Garden City, NY 11530	- - - -
EdMediaTec, Inc	E I
PO Box 230	- - - -
Wilkes-Barre, PA 18703	E I
Edmund Scientific Co	E I S P
101 E Gloucester Pike	- - - -
Barrington, NJ 08007	- - - -
Educ'al Teaching Aids/Div of	- - - -
A. Daigger/159 W Kenzie Street	E I
Chicago, IL 60610	E I
Educulture, Inc	- - - -
3184 J Airway Avenue	S P
Costa Mesa, CA 92626	- - - -
ENRICH, Inc	E S P
760 Kifer Road	I
Sunnyvale, CA 94086	E I S P
EPM Publications	I S
1003 Turkey Run Rd	- - - -
McLean, VA 22101 -	- - - -
ERIC/SMEAC Infor Ref Ctr/Ohio St	E I S P
Univ/Coll of Educ/1200 Chambers	- - - -
3d floor/Columbus, OH 43212	- - - -
Fearon/Pitman Publishers, Inc	E
6 Davis Drive	E
Belmont, CA 94002	- - - -
Federal Reserve Bank of Minn	S P
250 Marquette Avenue	- - - -
Minneapolis, MN 55480	- - - -
GeoBooks	E I
171 2d Street/Rm 401	- - - -
San Francisco, CA 94105	- - - -
Ginn & Co	I S
191 Spring St	- - - -
Lexington, MA 01273	- - - -
Anton Glaser	S P
1237 Whitney Road	- - - -
Southampton, PA 18966	- - - -
Globe Book Company, Inc	- - - -
175 Fifth Avenue	I S
New York, NY 10010	- - - -
Gram's Cookbook	- - - -
Box 194	I S P
Aurora, ON L4G 3H3	- - - -
Great Ideas, Inc.	- - - -
40 Oser Avenue	E I
Hauppauge, NY 11787	- - - -
Great Plains Natl Instructional	P
Television Library/Box 80669	- - - -
Lincoln, NE 68501	- - - -
GW School Supply	E I S P
PO Box 14	E I S P
Fresno, CA 93707	E I S
J L Hammett Company	- - - -
2393 Vauxhall Road	E I S
Union, NJ 07083	E I

Hampton and Associates	E I S P
636 N Lincoln Avenue	- - - -
Hinsdale, IL 60521	- - - -
Harcourt Brace Jovanovich, Inc	- - - -
School Dept/1372 Peachtree St, NE	E I
Atlanta, GA 30309	- - - -
Hawthorne Books, Inc	I
260 Madison Avenue	- - - -
New York, NY 10016	- - - -
D C Heath & Company	E I
125 Spring Street	- - - -
Lexington, MA 02173	- - - -
Home Economics Education Assoc	P
1201 16th St, NW	- - - -
Washington, DC 20036	- - - -
Houghton Mifflin Company	E I S
One Beacon Street	E I S
Boston, MA 02107	E I S
Hyper-Dynamics	S P
PO Box 392	- - - -
Santa Fe, NM 87501	- - - -
Ideal School Supply Company	- - - -
11000 S Lavergne	I S
Oak Lawn, IL 60453	E I S
Imperial Internatl Learning Corp	- - - -
PO Box 548	E
Kankakee, IL 60901	E
Instructo/McGraw-Hill	E I
Cedar Hollow & Matthews Hill Rds	E I
Paoli, PA 19301	E I
The Instructor Pub, Inc	E I
Instructor Park/7 Bank St	- - - -
Dansville, NY 14437	E
INTERSTATE	E I P
Printers & Publishers, Inc	- - - -
Danville, IL 61832	- - - -
J J Keller & Associates, Inc	I S P
145 W Wisconsin Ave	- - - -
Neenah, WI 54956	- - - -
Kent Educational Services	- - - -
PO Box 903	E I S P
Oviedo, FL 32765	- - - -
Laidlaw Brothers	- - - -
Thatcher and Madison	E I S
River Forest, IL 60305	- - - -
LaPine Scientific Company	E I S P
6001 South Knox Avenue	- - - -
Chicago, IL 60629	E I S P
Leicestershire Learning Systems	E I S P
Chestnut Street	- - - -
Lewiston, ME 04240	E I S
Lerner Publications Company	E I
241 First Avenue North	- - - -
Minneapolis, MN 55401	- - - -
Mafex Associates, Inc	E I S
90 Cherry Street	E I S
Johnstown, PA 15902	E I S
The Math Group, Inc	E I S
396 East 79th St	- - - -
Minneapolis, MN 55420	E I S

Math-Master	E I S
Box 1911	E I
Big Spring, TX 79720	E I S
McGraw-Hill, Inc	E I
1221 Ave of the Americas	- - - -
New York, NY 10020	- - - -
MCTM Publications	- - - -
Box 16124	E I S
Lansing, MI 48902	- - - -
Media Materials, Inc	- - - -
2936 Remington Ave	E I S
Baltimore, MD 21211	- - - -
Charles E Merrill Publishing Co	S
1300 Alum Creek Drive	E
Columbus, OH 43216	- - - -
Julian Messner, Div of Simon &	E
Schuster/1230 Ave of the Amer	- - - -
New York, NY 10020	- - - -
Metric Book Company	S
PO Box 75663	- - - -
Los Angeles, CA 90075	- - - -
Metric Commission (Canada)	P
301 Elgin St	- - - -
Ottawa, ON K1A 0H5	P
Metric Consultants	E I S P
21720 W North Avenue	- - - -
Brookfield, WI 53005	- - - -
Metric Genie Company	E I S P
PO Box 305	- - - -
Corte Madera, CA 94925	- - - -
Metric Teaching Aids	- - - -
Box 5616	E
Redwood City, CA 94063	E
Midwest Publications Co, Inc	E I S
PO Box 129	E I S
Troy, MI 48099	- - - -
Milton-Bradley Co	- - - -
Springfield, MA 01101	- - - -
	E I
Modern Math Materials	E I S P
1658 Albemarle Way	E I S
Burlingame, CA 94010	E I S
Monarch Press/Simon & Schust	- - - -
Bldg/1230 Ave of the Americas	E I S
New York, NY 10020	- - - -
NASCO	- - - -
Janesville Avenue	I S
Fort Atkinson, WI 53538	- - - -
Office of Technical Pubs/Natl Bur	- - - -
of Standards/US Dept of Commerce	- - - -
Washington, DC 20234	E I S P
Natl Council of Teachers of Math	P
1906 Association Drive	- - - -
Reston, VA 22091	E
National Micrographics Association	- - - -
8728 Colesville Road	- - - -
Silver Spring, MD 20910	E I S P
National Textbook Company	E I S
8259 Niles Center Road	- - - -
Skokie, IL 60076	- - - -
Thomas Nelson, Inc	E I S P
30 E 42d Street	- - - -
New York, NY 10017	- - - -
New American Library	E I S P
120 Woodbine Street	- - - -
Bergenfield, NJ 07621	- - - -
Orange County Dept of Education	- - - -
1250 South Grand Ave	I S
Santa Ana, CA 92705	- - - -
Parks and Math Company	E I S P
954 Idlewood Drive	I S P
San Jose, CA 95121	- - - -
Pathescope Educational Media, Inc	- - - -
71 Weyman Ave	I S P
New Rochelle, NY 10802	- - - -
Pauper Press	E I
Box 303	E I
Two Rivers, WI 54241	- - - -
J C Penney Co, Inc	- - - -
1301 Avenue of the Americas	- - - -
New York, NY 10019	S P
Penta-Gram Publications	- - - -
2191 St Celia	I S
Dubuque, IA 52001	- - - -
S G Phillips, Inc	I
305 W 86 Street	- - - -
New York, NY 10024	- - - -
Pickett Industries/386 N	P
Frontage Rd/Rio Rico Industrial Pk	P
Nogales, AZ 85621	- - - -
Polymetric Serv Inc/AMJ Pub Co Inc	E I S P
PO Box 847	E I S P
Tarzana, CA 91356	I S P
Prakken Publications, Inc	S P
416 Longshore Drive	- - - -
Ann Arbor, MI 48107	- - - -
Prentice-Hall Learning Sys, Inc	E I
P.O. Box 47X	E I
Englewood Cliffs, NJ 07632	E I
Prentice-Hall Media, Inc	- - - -
150 White Plains Road	I S P
Tarrytown, NY 10591	- - - -
Prindle, Weber & Schmidt	E P
20 Newbury Street	- - - -
Boston, MA 02116	- - - -
Random House Inc	- - - -
291 East 50th St	E I
New York, NY 10022	- - - -
Reeves Canada Ltd	- - - -
100 Dolomite Drive	E I
Downsview, ON M3J 2N3	- - - -
Ronningen Metric Company	P
PO Box 1869	- - - -
Sun City, AZ 85351	- - - -
Sadlier/Oxford, Div W H Sadlier	- - - -
11 Park Place	E I
New York, NY 10007	- - - -
Howard W Sams & Co, Inc	I P
4300 West 62d St	- - - -
Indianapolis, IN 46268	- - - -

Sargent-Welch Scientific Company		I S
7300 N Linder Avenue	- - - -	
Skokie, IL 60076	E I S	
Scholastic Magazines, Inc	E I	P
50 West 44th St	- - - -	
New York, NY 10036	E I	
School & Pre-School	- - - -	
Supply Ctr Inc/3501 Edmon[illegible]n Ave	- - - -	
Baltimore, MD 21229	E I	
Science Research Associates, Inc	E I	
155 North Wacker Drive	E I	
Chicago, IL 60606	- - - -	
Scott, Foresman, and Company	E I	
1900 East Lake Avenue	E I	
Glenview, IL 60025	- - - -	
Scott Resources, Inc	- - - -	
P.O. Box 2121	E I	
Fort Collins, CO 80522	- - - -	
Silver Burdett Co	E I S	
250 James Street	E I S	
Morristown, NJ 07960	E I	
The Smallstate Company		P
PO Box 796	- - - -	
Warwick, RI 02888	- - - -	
Society for Tech Communication		S P
1010 Vermont Ave, NW	- - - -	
Washington, DC 20005	- - - -	
Spectrum Educ'al Supplies Ltd	- - - -	
8 Denison Street	E I	
Markham, ON L3R 2P2	- - - -	
SRS Productions, Inc	E I	
4224 Ellenita Avenue	E	
Tarzana, CA 91356	E	
Sterling Publishing Co, Inc	E I	
419 Park Ave South	- - - -	
New York, NY 10016	- - - -	
Teachers	E I	
PO Box 398	E I	
Manhattan Beach, CA 90266	E I	
Teaching Aids Company	I S	P
925 South 300 West	I S	P
Salt Lake City, UT 84101	I S	P
Teaching Resources Films	- - - -	
2 Kisco Plaza	E I	
Mt Kisco, NY 10549	E I	
Technical Information Services	- - - -	
PO Box 24A34/Westwood Village Sta	- - - -	
Los Angeles, CA 90024	I S	P
3M Visual Products	- - - -	
3M Center	- - - -	
St Paul, MN 55101		P
Troubador Press	E I S	P
385 Fremont St	E I S	P
San Francisco, CA 94105	- - - -	
US Army Recruiting Command	- - - -	
Education Liaison Division	- - - -	
Fort Sheridan, IL 60037	S	P
Varner & Associates	- - - -	
4041 Richmond, Suite 500	S	P
Houston, TX 77027	- - - -	
Visual Materials, Inc	- - - -	
2549 Middlefield Road	E I	
Redwood City, CA 94063	- - - -	
Vogel Book Co	E I S	P
PO Box 103	E I S	P
Bellevue, WA 98009	- - - -	
J Weston Walch, Publisher	I S	
Box 658	- - - -	
Portland, ME 04104	- - - -	
Franklin Watts	E I S	
730 Fifth Avenue	- - - -	
New York, NY 10019	- - - -	
Weber Costello Company	- - - -	
1900 N Narragansett	- - - -	
Chicago, IL 60639	E I	
Western Learning Laboratories	E I	
PO Box 284	E I	
Culver City, CA 90230	E I	
John Wiley & Sons, Inc		P
605 Third Avenue		P
New York, NY 10016	- - - -	
Willow House Publishers	- - - -	
111 N San Joaquin Street	E I S	P
Stockton, CA 95202	- - - -	

MANIPULATIVE AIDS[1] & KITS[2]

Acme United Corp	E I S	P[1]
100 Hicks St	- - - -	-[2]
Bridgeport, CT 06609		
Activity Resources Co, Inc	E I S	P
Box 4875	E I S	P
Hayward, CA 94540		
Addison-Wesley (Canada) Ltd	E I S	
36 Prince Andrew Place	E I S	
Don Mills, ON M3C 2T8		
Addison-Wesley Publishing Co	E I S	P
2727 Sand Hill Rd	E I	
Menlo Park, CA 94025		
American Home Economics Assoc	- - - -	
2010 Massachusetts Ave, NW	I S	
Washington, DC 20036		
Audiotronics	- - - -	
7428 Bellaire Ave	I S	
North Hollywood, CA 91605		
Baker & Taylor Co	E I S	
6 Kirby Ave	E I S	
Somerville, NJ 08876		
A Balla & Company	E I S	P
2078 Integrity Drive N	E I	
Columbus, OH 43209		
Barron's Educational Series, Inc		S
113 Crossways Park Dr	- - - -	
Woodbury, NY 11797		
Bell & Howell/AV Prod Div	E I S	P
7100 McCormick Rd	E I S	P
Chicago, IL 60645		

BFA Educational Media
2211 Michigan Ave
Santa Monica, CA 90404
- - - -
E I

BHU
23358 Hartland St
Canoga Park, CA 91307
E I S
- - - -

Burgundy Press
P.O. Box 313
Southampton, PA 18966
- - - -
P

Campbell Soup Company
Home Economics Dept/Campbell Pl
Camden, NJ 08101
- - - -
I S P

Carlton Films/AV Media
3800 W Burleigh
Milwaukee, WI 53210
E I S
E I S

The Ctr for Open Learning &
Teaching Inc/PO Box 9434
Berkeley, CA 94709
E I S
- - - -

Clearvue, Inc
6666 No Oliphant Ave
Chicago, IL 60631
- - - -
E I S P

Collier Macmillan Canada Ltd
1125 B Leslie St
Don Mills, ON M3C 2K2
E I S
- - - -

Coronet Instructional Media
65 East South Water Street
Chicago, IL 60601
- - - -
E

Creative Publications, Inc
PO Box 10328
Palo Alto, CA 94303
E I S
- - - -

Creative Teaching Associates
PO Box 7766
Fresno, CA 93727
E I
E I

Creative Teaching Press, Inc
1900 Tyler #22
So El Monte, CA 91733
- - - -
E I

Thomas Y. Crowell Company
10 East 53d Street
New York, NY 10022
E I
- - - -

The C-Thru Ruler Company
6 Britton Drive
Bloomfield, CT 06002
E I S P
- - - -

Cuisenaire Co of America, Inc
12 Church Street
New Rochelle, NY 10805
E I
E I

Damon/Educational Division
80 Wilson Way
Westwood, MA 02090
E I S
E I

Dek-A-Music Company
355 Chateau Drive
LaPorte, IN 46350
E I
- - - -

Denoyer-Geppert Company
5235 Ravenswood Avenue
Chicago, IL 60640
E
- - - -

Developmental Learning Materials
7440 Natchez
Niles, IL 60648
- - - -
E I S

Dick Blick Company
P.O. Box 1267
Galesburg, IL 61401
E I S
E I S

Dixie/Marathon Prod
Div Amer Can Co/One Amer Lane
Greenwich, CT 06830
E I
- - - -

Doubleday & Company, Inc
501 Franklin Avenue
Garden City, NY 11530
E I S P
- - - -

EdMediaTec, Inc
PO Box 230
Wilkes-Barre, PA 18703
E I
E I

Edmund Scientific Co
101 E Gloucester Pike
Barrington, NJ 08007
P
E I P

Educ'al Teaching Aids, Div of
A. Daigger & Co/159 W Kenzie St
Chicago, IL 60610
E I S
E I S

Educulture, Inc
3184 J Airway Avenue
Costa Mesa, CA 92626
- - - -
S P

Encyclopaedia Brit Educ'al Corp
425 N Michigan Ave
Chicago, IL 60611
- - - -
E

ENRICH, Inc
760 Kifer Road
Sunnyvale, CA 94086
E I S P
E I S P

GeoBooks
171 2d Street/Rm 401
San Francisco, CA 94105
E I
- - - -

Ginn & Co
191 Spring St
Lexington, MA 01273
- - - -
E

Great Ideas, Inc.
40 Oser Avenue
Hauppauge, NY 11787
E I
- - - -

GW School Supply
PO Box 14
Fresno, CA 93707
E I S P
E I S P

J L Hammett Company
2393 Vauxhall Road
Union, NJ 07083
E I S
E I S

Hampton and Associates
636 N Lincoln Avenue
Hinsdale, IL 60521
E I S P
E I S P

D C Heath & Company
125 Spring Street
Lexington, MA 02173
- - - -
E I

Hobar Publications
1305 Tiller Lane
St. Paul, MN 55112
- - - -
I S P

Houghton Mifflin Company
One Beacon Street
Boston, MA 02107
E I
E I

Ideal School Supply Company
11000 S Lavergne
Oak Lawn, IL 60453
E I S P
- - - -

Imperial Internatl Learning Corp
PO Box 548
Kankakee, IL 60901
E
E

Instant Books of Metrics
9 South 9th St
Duncan, OK 73533
I S P
- - - -

Instructo/McGraw-Hill	E I
Cedar Hollow & Mattheus Hill Rds	E I
Paoli, PA 19301	
The Instructor Pub, Inc	E
Instructor Park/7 Bank St	- - - -
Dansville, NY 14437	
International Tutors	- - - -
22303 Devonshire Street	E I S P
Chatsworth, CA 91311	
Jaydee Specialites	E I S P
PO Box 536	- - - -
Wilmette, IL 60091	
Kenworthy Educational Service, Inc	- - - -
PO Box 3031	E
Buffalo, NY 14205	
LaPine Scientific Company	E
6001 South Knox Avenue	E I S P
Chicago, IL 60629	
Leicestershire Learning Systems	E I S P
Chestnut Street	E I S P
Lewiston, ME 04240	
Library Filmstrip Center	E I S P
3033 Aloma	- - - -
Wichita, KS 67211	
Mafex Associates, Inc	E I S
90 Cherry Street	E I S
Johnstown, PA 15902	
The Math Group, Inc	E I S
396 East 79th St	- - - -
Minneapolis, MN 55420	
Math-Master	E I S
Box 1911	E I S
Big Spring, TX 79720	
Media Materials, Inc	E I S
2936 Remington Ave	E I S
Baltimore, MD 21211	
Media Research Associates	- - - -
1712 23d Street, SE	E I
Salem, OR 97302	
Charles E Merrill Publishing Co	E
1300 Alum Creek Drive	E
Columbus, OH 43216	
Metric Book Company	S
PO Box 75663	- - - -
Los Angeles, CA 90075	
Metric Genie Company	E I S P
PO Box 305	- - - -
Corte Madera, CA 94925	
Metric Research Associates	- - - -
PO Box 414535	I S P
Miami Beach, FL 33141	
Metric Teaching Aids	S
Box 5616	I
Redwood City, CA 94063	
Metri-Key Metrication Systems	E I S P
PO Box 541	- - - -
Fenton, MO 63026	
Metrix Corporation	E I S P
PO Box 19101	- - - -
Orlando, FL 32814	
Milton-Bradley Co	E I
Springfield, MA 01101	- - - -
Modern Math Materials	- - - -
1658 Albemarle Way	E I S P
Burlingame, CA 94010	
NASCO	I S
Janesville Avenue	I S
Fort Atkinson, WI 53538	
Office of Technical Pubs/Natl Bur	- - - -
of Stan/US Dept of Commerce	E I S P
Washington, DC 20234	
National Micrographics Association	E I S P
Association/8728 Colesville Road	- - - -
Silver Spring, MD 20910	
Natl Science Teachers Assoc	- - - -
1742 Connecticut Ave	E I S
Washington, DC 20009	
Ohaus Scale Corp	E I S P
29 Hanover Road	- - - -
Florham Park, NJ 07932	
Pathescope Educational Media, Inc	- - - -
71 Weyman Ave	I S P
New Rochelle, NY 10802	
Penta-Gram Publications	E I S P
2191 St Celia	- - - -
Dubuque, IA 52001	
Perrygraf Division of Nashua Corp	E I S P
2215 Colby Avenue	E I S P
Los Angeles, CA 90064	
Polymetric Serv Inc/AMJ Pub Co Inc	I S P
PO Box 847	I S P
Tarzana, CA 91356	
Prentice-Hall Media, Inc	E
150 White Plains Road	E
Tarrytown, NY 10591	
Random House Inc	- - - -
291 East 50th St	E I
New York, NY 10022	
Reeves Canada Ltd	E I S
100 Dolomite Drive	E I S
Downsview, ON M3J 2N3	
Sargent-Welch Scientific Company	E I S
7300 N Linder Avenue	E I
Skokie, IL 60076	
Scholar's Choice Ltd	- - - -
1051 Clinton Street	E I S
Buffalo, NY 14206	
Scholastic Magazines, Inc	E I
50 West 44th St	E I
New York, NY 10036	
School & Pre-School Supply Ctr Inc	- - - -
5501 Edmondson Avenue	E I
Baltimore, MD 21229	
Science Research Associates, Inc.	E I
155 North Wacker Drive	E I
Chicago, IL 60606	
Sears, Roebuck & Co/Consumer Infor	P
Services/Dept 703/Sears Tower	- - - -
Chicago, IL 60684	

Selective Educational Equipment (SEE) Inc/3 Bridge St Newton, MA 02195	E I S E I	
Silver Burdett Co 250 James Street Morristo... NJ 07960	E I S E I	
The Smallstate Company PO Box 796 Warwick, RI 02888	E I S P - - - -	
Society for Visual Education, Inc 1345 Diversey Parkway Chicago, IL 60614	E I E I	
Spectrum Educational Supplies Ltd 8 Denison Street Markham, ON L3R 2P2	E I S E I	
SRS Productions, Inc 4224 Ellenita Avenue Tarzana, CA 01356	E E	
Sterling Plastics 253 Sheffield Street Mountainside, NJ 07092	S P E I	
Teachers PO Box 398 Manhattan Beach, CA 90266	E I - - - -	
Teaching Aids Company 925 South 300 West Salt Lake City, UT 84101	- - - - I S P	
Telex Communications Inc 9600 Aldrich Ave S Minneapolis, MN 55420	E I S P - - - -	
3M Visual Products 3M Center St Paul, MN 55101	P - - - -	
Triman Ltd Silica Road-Amington Ind Est Tamworth-Staffs-UK B77 4DT	E I S P E I S	
Troll Associates 320 Route 17 Mahwah, NJ 07430	- - - - E I	
Troubador Press 385 Fremont St San Francisco, CA 94105	E I S P - - - -	
USAF Educational Affairs Divison Randolf AFB, TX 78148	S - - - -	
US Army Recruiting Command Education Liaison Division Fort Sheridan, IL 60037	S P - - - -	
US Metric Association, Inc Sugarloaf Star Route Boulder, CO 80302	E I S P - - - -	
Varner & Associates 4041 Richmond, Suite 500 Houston, TX 77027	- - - - S P	
Weber Costello Company 1900 N Narragansett Chicago, IL 60639	E I S P I	
Western Learning Laboratories PO Box 284 Culver City, CA 90230	E I E I	
Xerox Education Publications 245 Long Hill Road Middletown, CT 06457	- - - - E	

FILMS[1] & FILMSTRIPS[2]

Addison-Wesley (Canada) Ltd 36 Prince Andrew Place Don Mills, ON M3C 2T8	- - - -[1] E I [2]	
Addison-Wesley Publishing Co 2727 Sand Hill Rd Menlo Park, CA 94025	- - - - E I	
Agency for Instructional Television/Box A Bloomington, IN 47401	E I - - - -	
AIMS Instructional Media Serv, Inc 626 Justin Ave Glendale, CA 91201	E I S P E I S P	
American Educational Films 132 Lasky Drive Beverly Hills, CA 90212	E I S P - - - -	
Baker & Taylor Co 6 Kirby Ave Somerville, NJ 08876	E I S E I S	
Barr Films 3490 E Foothill Blvd Pasadena, CA 91107	E - - - -	
Best Films PO Box 692/1335 Camino del Mar Delmar, CA 92014	I S P - - - -	
BFA Educational Media 2211 Michigan Ave Santa Monica, CA 90404	E I S P E I S	
B I P 36 Washington Street Wellesley Hills, MA 02181	I E I	
Stephen Bosustow Productions 1649 11th St Santa Barbara, CA 90404	E I S P E I S P	
R W Bruce Company 212 Carroll Bldg/8600 LaSalle Rd Towson, MD 21204	- - - - E	
California State Dept of Educ 721 Capitol Mall Sacramento, CA 95616	E I S P - - - -	
Carlton Films/AV Media 3800 W Burleigh Milwaukee, WI 53210	- - - - E I S	
Clearvue, Inc 6666 No Oliphant Ave Chicago, IL 60631	- - - - E I S P	
The Continental Press, Inc 520 E. Bainbridge St Elizabethtown, PA 17022	- - - - I S	

Coronet Instructional Media 65 East South Water Street Chicago, IL 60601	E I S E I
Creative Learning, Inc 19 Market Street Warren, RI 02885	- - - - E
Thomas Y. Crowell Company 10 East 53d Street New York, NY 10022	- - - - E
Davidson Films, Inc 3701 Buchanan St San Francisco, CA 94123	E - - - -
Denoyer-Geppert Company 5235 Ravenswood Avenue Chicago, IL 60640	- - - - E
EdMediaTec, Inc PO Box 230 Wilkes-Barre, PA 18703	- - - - E I
Educational Activities, Inc. PO Box 392 Freeport, NY 11520	- - - - E I
Educational Film Systems 11466 San Vincente Blvd Los Angeles, CA 90049	E I S P - - - -
Educational Projections Company 3080 Lake Terrace Glenview, IL 60025	- - - - E I S P
Educational Record Sales 157 Chambers Street New York, NY 10007	- - - - E
GW School Supply PO Box 14 Fresno, CA 93707	- - - - E I
Harper & Row, Publishers 10 East 53d St New York, NY 10022	- - - - I S P
Holt, Rinehart & Winston, CBS, Inc 383 Madison Avenue New York, NY 10017	- - - - E I
Houghton Mifflin Company One Beacon Street Boston, MA 02107	- - - - I S
Ideal School Supply Company 11000 S Lavergne Oak Lawn, IL 60453	- - - - E I
Imperial Internatl Learning Corp PO Box 548 Kankakee, IL 60901	- - - - E
International Tutors 22303 Devonshire Street Chatsworth, CA 91311	- - - - E I S P
Journal Films, Inc 930 Pitner Ave Evanston, IL 60202	E I - - - -
LaPine Scientific Company 6001 South Knox Avenue Chicago, IL 60629	E I S P E I S P
Library Filmstrip Center 3033 Aloma Wichita, KS 67211	- - - - E I S P
Math-Master Box 1911 Big Spring, TX 79720	- - - - E I S
McGraw-Hill, Inc 1221 Ave of the Americas New York, NY 10020	E I S E I S
Charles E Merrill Publishing Co 1300 Alum Creek Drive Columbus, OH 43216	- - - - E
Metric Consultants 21720 W North Avenue Brookfield, WI 53005	E I S P E I S P
Miller-Brody Productions, Inc 342 Madison Avenue New York, NY 10017	- - - - E
Milton-Bradley Co Springfield, MA 01101	- - - - I
NBC Educational Enterprises 30 Rockefeller Plaza New York, NY 10020	E I S P - - - -
Paramount Communications 5451 Marathon Street Hollywood, CA 90038	E - - - -
Pathescope Educational Media, Inc 71 Weyman Ave New Rochelle, NY 1080	- - - - I S P
J C Penney Co, Inc 1301 Avenue of the Americas New York, NY 10019	- - - - E I S P
Pennsylvania State Univ/AV Serv 17 Willard Bldg University Park, PA 16802	S P - - - -
Perennial Education, Inc 1825 Willow Road Northfield, IL 60093	E I S P - - - -
Polymetric Serv Inc/AMJ Pub Co Inc PO Box 847 Tarzana, CA 91356	S P S P
Prentice-Hall Media, Inc 150 White Plains Road Tarrytown, NY 10591	- - - - E I S P
Pyramid Films Box 1048 Santa Monica, CA 90406	I S P - - - -
Sargent-Welch Scientific Company 7300 N Linder Avenue Skokie, IL 60076	- - - - E I S
Silver Burdett Co 250 James Street Morristown, NJ 07960	- - - - E I S
Society for Visual Education, Inc 1345 Diversey Parkway Chicago, IL 60614	- - - - E I S
SRS Productions, Inc 4224 Ellenita Avenue Tarzana, CA 01356	E - - - -
Sterling Educational Films 241 East 34 Street New York, NY 10016	I S E

Teaching Resources Films 2 Kisco Plaza Mt Kisco, NY 10549	- - - - E I	Walt Disney Educational Media Co 500 South Buena Vista Street Burbank, CA 91521	E I S E I S
Troll Associates 320 Route 17 Mahwah, NJ 07430	- - - - E I	Weber Costello Company 1900 N Narragansett Chicago, IL 60639	- - - - E I
United Learning 6633 W Howard St Niles, IL 60648	- - - - E I	Xerox Education Publications 245 Long Hill Road Middletown, CT 06457	E S E

FILMLOOPS[1] & VIDEO-CASSETTES[2]

Agency for Instructional Television/Box A Bloomington, IN 47401	- - - -[1] E I S [2]	Orange County Dept of Education 1250 South Grand Ave Santa Ana, CA 92705	E - - - -
Baker & Taylor Co 6 Kirby Ave Somerville, NJ 08876	E I S - - - -	Perennial Education, Inc 1825 Willow Road Northfield, IL 60093	- - - - E I S P
Great Plains Natl Instructional Television Library/Box 80669 Lincoln, NE 68501	- - - - E I S P	SRS Productions, Inc 4224 Ellenita Avenue Tarzana, CA 01356	- - - - E
Houghton Mifflin Company One Beacon Street Boston, MA 02107	E I - - - -	Varner & Associates 4041 Richmond, Suite 500 Houston, TX 77027	- - - - I S
LaPine Scientific Company 6001 South Knox Avenue Chicago, IL 60629	E I S P - - - -		

SLIDES AND TRANSPARENCIES

Baker & Taylor Co 6 Kirby Ave Somerville, NJ 08876	E I S	Hampton and Associates 636 N Lincoln Avenue Hinsdale, IL 60521	E I S P
Burgundy Press P.O. Box 313 Southampton, PA 18966	P	Hobar Publications 1305 Tiller Lane St. Paul, MN 55112	S P
Carlton Films/AV Media 3800 W Burleigh Milwaukee, WI 53210	E I S	Imperial Internatl Learning Corp PO Box 548 Kankakee, IL 60901	E
Clearvue, Inc 6666 No Oliphant Ave Chicago, IL 60631	I S P	LaPine Scientific Company 6001 South Knox Avenue Chicago, IL 60629	E I S P
Denoyer-Geppert Company 5235 Ravenswood Avenue Chicago, IL 60640	E	Math-Master Box 1911 Big Spring, TX 79720	E I S
Dick Blick Company P.O. Box 1267 Galesburg, IL 61401	E I S	Metric Consultants 21720 W North Avenue Brookfield, WI 53005	E I S P
Educational Record Sales 157 Chambers Street New York, NY 10007	E I S	NASCO Janesville Avenue Fort Atkinson, WI 53538	I S
Great Plains Natl Instructional Television Library/Box 80669 Lincoln, NE 68501	I	Penta-Gram Publications 2191 St Celia Dubuque, IA 52001	E I S P
GW School Supply PO Box 14 Fresno, CA 93707	E	Polymetric Serv Inc/AMJ Pub Co Inc PO Box 847 Tarzana, CA 91356	S P
J L Hammett Company 2393 Vauxhall Road Union, NJ 07083	E I	Sargent-Welch Scientific Company 7300 N Linder Avenue Skokie, IL 60076	E I S

School & Pre-School Supply Ctr, Inc/5301 Edmondson Ave Baltimore, MD 21229	E I
3M Visual Products 3M Center St Paul, MN 55101	P
United Transparencies, Inc PO Box 688 Binghamton, NY 13902	I S
Varner & Associates 4041 Richmond, Suite 500 Houston, TX 77027	E I
Visual Materials, Inc 2549 Middlefield Road Redwood City, CA 94063	E I

AUDIO-CASSETTES[1] & RECORDS[2]

Addison-Wesley (Canada) Ltd 36 Prince Andrew Place Don Mills, ON M3C 2T8	E I - - - -	1 2	
Baker & Taylor Co 6 Kirby Ave Somerville, NJ 08876	E I S - - - -		
BFA Educational Media 2211 Michigan Ave Santa Monica, CA 90404	E I S - - - -		
B I P 36 Washington Street Wellesley Hills, MA 02181	E I - - - -		
R W Bruce Company 212 Carroll Bldg/8600 LaSalle Rd Towson, MD 21204	E - - - -		
Carlton Films/AV Media 3800 W Burleigh Milwaukee, WI 53210	E I S - - - -		
Center for Vocational Education Ohio State Univ/1960 Kenny Rd Columbus, OH 43210	P - - - -		
Coronet Instructional Media 65 East South Water Street Chicago, IL 60601	I S - - - -		
Creative Learning, Inc 19 Market Street Warren, RI 02885	E - - - -		
Thomas Y. Crowell Company 10 East 53d Street New York, NY 10022	E - - - -		
Damon/Educational Division 80 Wilson Way Westwood, MA 02090	E - - - -		
EdMediaTec, Inc PO Box 230 Wilkes-Barre, PA 18703	E I - - - -		
Educational Activities, Inc. PO Box 392 Freeport, NY 11520	E I - - - -		
Educational Film Systems 11466 San Vincente Blvd Los Angeles, CA 90049	E I S P E I S		
Educational Record Sales 157 Chambers Street New York, NY 10007	E I		
Educulture, Inc. 3184 J Airway Avenue Costa Mesa, CA 92626	S P - - - -		
GW School Supply PO Box 14 Fresno, CA 93707	E I E I		
Harper & Row, Publishers 10 East 53d St New York, NY 10022	I S P - - - -		
Holt, Rinehart & Winston, CBS, Inc/383 Madison Avenue New York, NY 10017	E I - - - -		
Houghton Mifflin Company One Beacon Street Boston, MA 02107	E I S - - - -		
International Tutors 22303 Devonshire Street Chatsworth, CA 91311	E I S P - - - -		
LaPine Scientific Company 6001 South Knox Avenue Chicago, IL 60629	E I - - - -		
Library Filmstrip Center 3033 Aloma Wichita, KS 67211	E I S P E I S P		
Math-Master Box 1911 Big Spring, TX 79720	E I S - - - -		
Media Materials, Inc 2936 Remington Ave Baltimore, MD 21211	E I S - - - -		
Charles E Merrill Publishing Co 1300 Alum Creek Drive Columbus, OH 43216	E - - - -		
Miller-Brody Productions, Inc 342 Madison Avenue New York, NY 10017	E E		
Milton-Bradley Co Springfield, MA 01101	E - - - -		
NASCO Janesville Avenue Fort Atkinson, WI 53538	I S - - - -		
Orange County Dept of Education 1250 South Grand Ave Santa Ana, CA 92705	E - - - -		
Pathescope Educ'al Media, Inc 71 Weyman Ave New Rochelle, NY 10802	I S P - - - -		
J C Penney Co, Inc 1301 Avenue of the Americas New York, NY 10019	E I S P - - - -		

Polymetric Serv Inc/AMJ Pub Co Inc — P
PO Box 847 — - - - -
Tarzana, CA 91356

Prentice-Hall Media, Inc — E I S P
150 White Plains Road — - - - -
Tarrytown, NY 10591

Sargent-Welch Scientific Company — E I S
7300 N Linder Avenue — - - - -
Skokie, IL 60076

Science Research Associates, Inc. — E I
155 North Wacker Drive — - - - -
Chicago, IL 60606

Silver Burdett Co — E I
250 James Street — - - - -
Morristown, NJ 07960

Teaching Resources Films — E I
2 Kisco Plaza — - - - -
Mt Kisco, NY 10549

3M Visual Products — P
3M Center — - - - -
St Paul, MN 55101

Troll Associates — E I
320 Route 17 — - - - -
Mahwah, NJ 07430

Weber Costello Compar — I S
1900 N Narragansett — - - - -
Chicago, IL 60639

PERIODICALS[1] & REPORTS AND PAMPHLETS[2]

Amer Assoc of School Librarians — - - - -[1]
50 East Huron St — E I S P[2]
Chicago, IL 60611

American Book Co — E
450 West 33d St — E
New York, NY 10001

American Institutes for Research — P
Metric Studies Ctr/PO Box 1113 — P
Palo Alto, CA 94302

American National Metric Council — P
1625 Massachusetts Ave, NW — P
Washington, DC 20036

American National Standards — - - - -
Institute/1430 Broadway — S P
New York, NY 10018

Burgundy Press — - - - -
P.O. Box 313 — P
Southampton, PA 18966

California State Dept of Educ — - - - -
721 Capitol Mall — E I S
Sacramento, CA 95616

Canadian Metric Association — P
PO Box 35 — E I S P
Fonthill, ON L0S 1E0

Clearvue, Inc — - - - -
6666 No Oliphant Ave — I S P
Chicago, IL 60631

EdMediaTec, Inc — - - - -
PO Box 230 — E I
Wilkes-Barre, PA 18703

Extension Food Sci Dept/Univ of GA — - - - -
Cooperative Extension Service — I S P
Athens, GA 30602

GW School Supply — - - - -
PO Box 14 — E I
Fresno, CA 93707

Home Economics Education Assoc — - - - -
1201 16th St, NW — S P
Washington, DC 20036

J J Keller & Associates, Inc — I S P
145 W Wisconsin Ave — I S P
Neenah, WI 54956

Mafex Associates, Inc — - - - -
90 Cherry Street — E I S
Johnstown, PA 15902

Metric Commission (Canada) — P
301 Elgin St — P
Ottawa, ON K1A 0H5

Metric Consultants — - - - -
21720 W North Avenue — E I S P
Brookfield, WI 53005

Metric Teaching Aids — - - - -
Box 5616 — E
Redwood City, CA 94063

Office of Tech Pub/Natl Bur — - - - -
of Standards/US Dept of Commerce — I S P
Washington, DC 20234

National Council of Teachers — - - - -
of Math/1906 Association Dr — E I S P
Reston, VA 22091

National Education Assoc Pub — - - - -
1201 16th Street, NW — P
Washington, DC 20036

Natl Science Teachers Assoc — - - - -
1742 Connecticut Ave — E I S
Washington, DC 20009

J C Penney Co, Inc — - - - -
1301 Avenue of the Americas — I ?
New York, NY 10019

Polymetric Serv Inc/AMJ Pub Co Inc — E I S P
PO Box 847 — - - - -
Tarzana, CA 91356

Roe International Inc — - - - -
Roe Place — E I S
Patchogue, NY 11772

Running Press — - - - -
38 S 19th Street — P
Philadelphia, PA 19103

School & Pre-School Supply — - - - -
Ctr, Inc/5501 Edmondson Avenue — E I
Baltimore, MD 21229

Sci & Math Teach Ctr/Clg of — - - - -
Educ Pub/Erickson Hall/MI St Univ — E P
East Lansing, MI 48836

Sears, Roebuck & Co/Consumer Info - - - -
Services/Dept 703/Sears Tower I S P
Chicago, IL 60684

Silver Burdett Co - - - -
250 James Street E I
Morristown, NJ 07960

The Smallstate Company E I S P
PO Box 796 P
Warwick, RI 02888

US Metric Association, Inc P
Sugarloaf Star Route P
Boulder, CO 80302

GAMES

Addison-Wesley Publishing Co
2727 Sand Hill Rd E I
Menlo Park, CA 94025

Copp Clark Publishing
517 Wellington Street West E I S
Toronto, ON M5V 1G1

Creative Teaching Associates
P.O. Box 7766 E I
Fresno, CA 93727

Damon/Educational Division
80 Wilson Way E I S
Westwood, MA 02090

Dek-A-Music Company
355 Chateau Drive E I
LaPorte, IN 46350

Developmental Learning Materials
7440 Natchez I S P
Niles, IL 60648

Great Ideas, Inc.
40 Oser Avenue E I S
Hauppauge, NY 11787

GW School Supply
PO Box 14 E I S P
Fresno, CA 93707

Hampton and Associates
636 N Lincoln Avenue E I S P
Hinsdale, IL 60521

Ideal School Supply Company
11000 S Lavergne E I S
Oak Lawn, IL 60453

Instructo/McGraw-Hill
Cedar Hollow & Matthews Hill Rds E I
Paoli, PA 19301

Kent Educational Services
PO Box 903 E I
Oviedo, FL 32765

Mafex Associates, Inc
90 Cherry Street E I S
Johnstown, PA 15902

The Math Group, Inc E I S
396 East 79th St
Minneapolis, MN 55420

Metrix Corporation
PO Box 19101 E I S P
Orlando, CA 32814

NASCO
Janesville Avenue E I S
Fort Atkinson, WI 53538

Natl Enterprises & Develop Inc
3459 South Acoma/PO Box 691 E I S P
Englewood, CO 80151

Odlot Game Company
Box 27 E I S P
Jamestown, MI 49427

Selective Educational Equipment
(SEE) Inc/3 Bridge St E I S
Newton, MA 02195

Silver Burdett Co
250 James Street I
Morristown, NJ 07960

S I W Metric Games
Box 2602 I S
El Cajon, CA 92021

J Weston Walch, Publisher
Box 658 I S
Portland, ME 04104

DUPLICATING MASTERS

American Dairy Queen Corp
PO Box 14312 E I
Dayton, OH 45414

Bell & Howell/AV Prod Div
7100 McCormick Rd E I S
Chicago, IL 60645

EdMediaTec, Inc
PO Box 230 E I
Wilkes-Barre, PA 18703

GW School Supply
PO Box 14 E I S P
Fresno, CA 93707

Holt, Rinehart & Winston, CBS, Inc
383 Madison Avenue E I P
New York, NY 10017

Instructo/McGraw-Hill
Cedar Hollow & Matthews Hill Rds E I
Paoli, PA 19301

The Instructor Pub, Inc
Instructor Park/7 Bank St E I
Dansville, NY 14437

National Textbook Company
8259 Niles Center Road E I S
Skokie, IL 60076

Prentice-Hall Learning Systems Inc
P.O. Box 47X E I
Englewood Cliffs, NJ 07632

Silver Burdett Co
250 James Street E I S
Morristown, NJ 07960